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THE DIFFERENTIATION OF SPECIES[1]

WITH the lapse of another year, it is again my privilege and my obligation to present what is technically known as a "presidential address." This occasion is one of particular personal interest, for it marks the close of continuous active service to the academy throughout a period of more than three decades, during which it has been my privilege to serve in almost every designated capacity. And with the close of this evening, I shall pass to the long and venerable list of ex-presidents, however unworthy that association may be with the notable men of science of our community who have directed the life and work of our institution.

A choice of subjects is inevitably controlled by circumstances; the topic must be general in scope, it must be of timely interest, and it ought to be one with which the speaker is familiar, at least to some extent. I have chosen to discuss briefly some aspects of evolution. No other is more comprehensive or more fundamental. Each of the natural sciences, with its own materials and by its own methods, has demonstrated the reality of incessant change, in the heavenly bodies, in mountains and seas and continents, and in the wide array of plants and animals that constitute the organic world.

The further circumstance determining this choice is the fact that for more than twenty odd years I have been engaged in the study of a definite group of animal organisms in an effort to understand the processes by which evolution comes about in wild nature. The natural history of animals is like that of plants, and hence this topic is directly related to botanical generalization. It is of real concern to the geologist also, who, as paleontologist, must deal with the bygone organisms that have lived and have passed away. It is axiomatic, of course, that the student of fossil species can not observe directly the dynamics of specific evolution; what he may know about the actual processes of transmutation can be learned only by the study of existing organisms and their changes, which he then projects into the past—precisely as the geologist can not see his age-old strata in process of

[1] Address of the retiring president, delivered at the annual meeting of the New York Academy of Sciences, December 19, 1927. Photographic illustrations of topographic features, specimens and tabulated statistics, which were employed at the time, are necessarily omitted here.

actual formation, although he can understand their origins from what he now observes in the way of erosion, deposition, solidification and uplift.

The material with which I shall deal specifically consists of certain land-snails that dwell in the larger and higher islands of the western and southern Pacific Ocean. They belong to various and varied species of the single genus Partula. In the course of the past twenty years more than 150,000 individuals have been secured in several groups of islands. As the adult animals are viviparous, the young dissected from the brood-chambers of their parents afford valuable data for heredity. The young number about 250,000. Hence the material comprises an ample array of over 400,000 individuals for the study of distribution, variation, heredity and organic differentiation—which last phrase means evolution.

Last year I presented a general description of these animals and their local distribution, showing how each group of islands bears its own characteristic species, and how each island of a single group is inhabited by forms that occur nowhere else. Indeed, in some instances a given species is confined to a single mountain peak or to a restricted area not more than a hundred yards in any diameter. From such facts of distribution, and from the correlation between geographical proximity and specific similarity, it is possible to decode the history of organic differentiation by which the present situation has come about. And incidentally it was shown also how the zoogeographical data are valuable for the purely geological problem of a pre-Pacific continent.

On this occasion, employing the identical facts of Partula nature and distribution, I purpose to discuss some other aspects of the problem of organic differentiation, and to express some of the convictions that have gained form and definition in the course of the detailed studies of an unusual wealth of material. No claim is made that my conclusions are original or novel, for their like are to be found in commentary and controversial literature. But even at this date in the discussion of evolutionary dynamics, conflicting views are presented to us, more often on theoretical grounds than on the basis of an analysis of organic variation in nature. The Partula work is concrete and circumstantial, and its results make it possible to present definite statements regarding many of the controverted questions of evolutionary procedure.

In particular, the topics are, first and principally, the concept of species, and the change in focus that I believe to be essential if progress is to be made in the analysis of the origin of species in nature; the second is the Darwinian formula of natural selection, and the precise form of its statement that holds for the history of Partula evolution, particularly as regards the problems of utility and the survival value of small congenital variations. The third topic, to be dealt with very briefly, is the opposition of fortuity and orthogenesis. A final profession of evolutionary faith will conclude the discussion.

Our present concept of a species is a heritage from the eighteenth century. It has been useful, and indeed indispensable for the organization of biological information, but at the same time in some ways it has deterred progress in analyzing and understanding the modes by which diverse organic types have come into existence. In medieval times the concept did not exist as such, until with the era of Suarez the evolutionary views of earlier centuries, sanctioned and expounded by the orthodox fathers of the church like St. Augustine and St. Thomas Aquinas, were cast aside in favor of the dogma of supernatural creation, according to which, once for all time, all kinds of living creatures came into being in the Garden of Eden, unchanged and unchangeable. Yet the special creationists themselves were by no means in agreement as to the natures and numbers of organisms thus first constituted. According to some, like Bory de Saint Vincent and Gmelin, the original kinds were what would be called to-day the generic types—Felis, Canis, Homo. As time passed, by natural resolution, each of these was supposed to be divided up into lesser components, such as the species, *Felis leo, Felis tigris,* etc. Others, like Ray and Linnaeus, held that the latter were the primary types; and while at first Linnaeus contended that these had undergone no organic diversification since their creation, later he espoused the belief that transmutation within species had produced different varieties or sub-species. Again, Jordan held that these lesser units—the varieties—were the original things and that a species was an arbitrary aggregate, precisely as a Linnaean genus was a convenient collection of essentially similar types, assembled by convention.

During this period, when the idea of supernatural creation held sway, there was no problem of the *origin* of species, for the various kinds were postulated *ab initio,* just as in embryology the false preformationist views of Bonnet and Haller excluded the problem of embryological differentiation. Such a concept could not have other than a baneful effect upon investigation, for whatever allowance was made for transmutation within genera or within species, this was regarded as quite subordinate to the supernatural fixation of the first-formed kinds, and a general program of organic evolution was impossible.

With Darwin and his work, the whole matter entered its modern phase, when universal organic transmutation came to be fully established, and when the species came to be understood as an artificial concept, like the concept of genus, of order, of family and of class. It is true that the Linnean form of the idea still controlled taxonomy among the major divisions of biology, and it still rules evolutionary discussion to an extent which many, myself included, hold to be unjustifiable and harmful. It is impossible to outline the true conception of species more clearly than in the words of Darwin himself, and while the correct idea is now axiomatic, we must not forget that this was by no means the case when Darwin wrote. He says:

> Certainly no clear line of demarcation has as yet been drawn between species and sub-species—that is, the forms which in the opinion of some naturalists come very near to, but do not quite arrive at, the rank of species: or, again, between sub-species and well-marked varieties, or between lesser varieties and individual differences. These differences blend into each other by an insensible series; and a series that impresses the mind with the idea of an actual passage.
>
> Hence I look at individual differences, though of small interest to the systematist, as of the highest importance for us, as being the first steps towards such slight varieties as are barely thought worth recording in works on natural history. And I look at varieties which are in any degree more distinct and permanent, as steps towards more strongly-marked and permanent varieties; and at the latter as leading to sub-species, and then to species . . . A well-marked variety may therefore be called an incipient species . . .

Here we have a definite statement that a species is only one term in an array of assemblages of lesser or greater comprehensiveness and scope. To focus attention on just that degree of difference which by convention is taken to be specific in degree is no more helpful than to concentrate on the greater degree of difference between two genera or two families. In fact, it diverts attention from the point where the enquiry into the origin of diverse organic types must begin, namely, the production of the individual variant itself, and the passage from parent to offspring. For here, and here only, can the dynamics of organic differentiation come under direct observation. Anything else is deduced. It is admitted, of course, that comparative morphology, crystallized into taxonomy, must take some conventional degree of difference from which to work, and on account of the historical strength of the species idea, it starts with what *on detailed analysis* proves to be a relatively large and a derived degree of difference. From this, it works mainly upwards to genera and to larger groups. But when it proceeds downwards from the same point, namely, to varieties, subvarieties and ultimately to individual variants, it is working in the direction opposite to that of natural organic differentiation.

For purely descriptive purposes, in my own work, it has been necessary to start with the individual variants, and to establish groupings below variety which have the same relation to subspecies as that of subspecies to species, species to genera and so on. All individuals that are alike in at least one distinguishable quality, however they may differ in others, constitute what I call a *gens*—a name that is closely similar to the word gene of the geneticists, and the similarity in name correctly implies that the identical manifest qualities are due to similar genetic factors. Aggregates of *gentes* form a *cohort*—a more inclusive grouping with greater intrinsic diversity than the *gens*. *Cohorts* constitute a *socius*—that is, a geographically outlined assemblage built up of the lesser components. Several *socii*, or indeed a single *socius*, may present a complexion that is collectively distinctive, and hence, they, or it, will form a *variety*, or better a *primary variety*, still more comprehensive and with a still greater diversity among its members. Such *varieties* constitute the *species*, and the rest follows according to convention.

It may sound paradoxical, but it has become increasingly evident to me in prosecuting my own work, that little if any understanding of the *origin* of diverse organic types can be gained through the study of genera, species or even varieties, *after* they have arisen. We can gain knowledge of their evolutionary connections, it is true, on the principle that the degree of likeness is an index of the degree of genetic relationship, for there is no known reason for organic similarity other than common ancestry. But the factors that have made varieties dissimilar, species more unlike, and genera still more so, are not there to be discovered. Let me repeat that we must concentrate on the initial episode when individual offspring present themselves as something different from their parents. What happens when gentes come to differ within their cohort, cohorts within their socii, varieties within the species and species within their genera, is universally the same, and it is nothing but the initial episode repeated again and again.

The conclusion at which we arrive therefore is in effect that the geneticists and they alone are working on the fundamental dynamics of organic differentiation. With the conjunction of Weismannian cytology and Mendelian experimentation a new era was begun, and its accomplishments in the brief period of

twenty-five years are known to all. Now, I believe, we require the same kind of combination of effort, on the part of geneticists who work in the experimental garden and laboratory with complete control of conditions, and of what might be called the analytical taxonomists, who deal with organisms in open nature. Having the assured principles of genetics, the field-worker is justified in postulating an internal genetic control of his minor variations exactly like that which manifests itself in the succession of changing laboratory generations, just as a pair of qualities that are newly found to Mendelize may confidently be referred to chromosomal direction, even though the cytological demonstration in question may not have been made.

So far as the material of Partula is concerned, the elementary episodes of organic differentiation that have been demonstrated, and the long history of evolution rewritten by deduction, reveal no primary or originative factors at work other than those of congenital nature and location. Thus the results are in full accord with those of laboratory genetics, which allow for external control of the behavior of qualities, it is true, but find no evidence that external conditions actually originate new qualities as such. Despite the fundamental importance of this subject, this brief statement is all that can be given in the present connection.

And now a few words regarding mutation and the supposed conflict between the doctrine of mutation and Darwin's views. The antithesis in question, for which De Vries is largely responsible, has long since disappeared from the only writings that deal directly with the facts, namely, those in the field of genetics. Nowadays the word mutation is used to apply to any congenital departure or variation, whatever it may be in degree. Its real antithesis is a change due to the operation of an external influence, or a somatic modification, sometimes named a fluctuation. Numerous instances of true mutations have been discovered in Partula and in numerous species. Sometimes the new type is rare, like the sinistral mutants in *P. taeniata,* where they number only four out of sixty thousand individuals. Sometimes the novel condition is more frequent, as in many of the color-varieties, or cohorts. These instances prove to be true mutations, for some among the embryonic offspring repeat the new parental character and thus carry it over to posterity.

We come now to the second topic, natural selection, and the way natural selection enters into the evolutionary history of the Partula material. To forestall any possible misapprehension later, let me state at once that I hold myself to be a true believer in orthodox natural selection. Darwin clearly separates this from congenital variation and takes the latter as given, so to speak. Others of the neo-Darwinian school attempted to expand natural selection so as to make it originative in effect as well as discriminatory, notably those who propounded the theory of germinal selection. As to the truth of the elements of natural selection, there can be no two opinions. Given the fact that congenital variations do arise universally, it is found that in general organisms multiply at an excessive rate, and they are thus plunged into some sort of struggle for existence; the unadapted perish, and thus the only ones to carry on are those which are predestined to succeed by their congenital make-up. The crucial point in the whole formula is the matter of the survival value of small differences. Darwin himself did not insist on the positive utility of such individual differences, for he discusses at length a whole series of what he calls "indifferent characters." But Wallace took the extreme position and argued that whether the observer can or can not discern just how a small difference may have been useful, yet it must have been so, else the possessor could not survive. This really begs the whole question. Of course the literature is full of citations of directly useless and eliminative characters that are congenital in origin as mutations, such as the lethal factors in Drosophila and the uni-sexual organization of some of De Vries' primroses. But an unprejudiced review of the many individual differences displayed by the Partulae, whether they be small or large in degree, finds no reason to believe that they are of direct benefit to their possessors, or otherwise. The statement that congenital variation *must not be inutile* or detrimental has really the correct form, as I believe; and I do not regard it as any less Darwinian than any other element of the doctrine of natural selection.

The third topic—fortuity *vs.* orthogenesis—must be dismissed with very brief consideration. There is no evidence that the variations in the Partula material have proceeded along orthogenetic lines, while all the evidence is to the contrary effect. It is not possible here and now to present the detailed facts which warrant the foregoing general conclusion and the following brief statement. The qualities of the gentes which compose a cohort differ fortuitously in such a way as to form a continuous polygon of frequency. The cohorts, when treated statistically, also disclose a continuous relationship. When the socii themselves are assembled, they vary about an average condition in the same way that individual variants group themselves about a median condition. Let me recall the primary contention that it is here in the earlier stages of organic differentiation that

we must look for the true facts. If orthogenesis is real, it will be found here. But the evidence is all to the contrary. I am well aware that this may seem to be a very cavalier treatment of a large subject, but it is my purpose only to present the conclusions which are authorized and justified by the results of the present investigation. And this summary statement must suffice.

And now, by way of conclusion, I may outline what I believe to be the full and correct statement regarding the history of organic differentiation among the Partulae, as it has gone forward in the past and as it is proceeding to-day. The efficient causes of evolution are congenital, and their work is manifested by the continuance of some among the parental qualities; but these are never repeated faithfully, for the hereditary chromosomal machinery is such that exact similarity is impossible. The individual differences may be small or larger, but the degree is unimportant—it is congenital causation that is the essential element. The variants then exercise their hereditary endowments as they may, with success or failure as the outcome of their accord with the whole complex of surrounding circumstances. They must not be unadapted—this is the true biological categorical imperative. Nature makes a wide allowance in the matter of actual utilitarian values.

Variation and heredity, then, are the two aspects of the workings of the internal factorial machinery; natural selection, with which I include spatial and physiological isolation, does the rest. The whole complex of external conditions, whatever these may chance to be, does nothing in the way of originating variations; its effects are limited to an acceptance, a tolerance or a rejection of the varied aspirants for the career of a complete organic life.

HENRY E. CRAMPTON

BARNARD COLLEGE,
COLUMBIA UNIVERSITY

RESEARCH AND THE TRAINING OF THE RESEARCHER

I

RESEARCH is systematic and critical investigation into the sources of truth; it is a characteristic and proudly accepted function of the university. In the eyes of the world the university degree, the doctor's degree, stands for competency in scholarly pursuit of truth. In granting the degree the university acknowledges, tacitly at least, responsibility for *training in research* of potential researchers. Are the functions desirably to be differentiated?

(1) One policy, not uncommon, admits the candidate for the doctor's degree to a professorial undertaking in research. He may, at the discretion of the professor, take such part in the investigation as appears compatible with its validity and profit therefrom in "training" as he can. Responsibility, however, lies with the professor; the investigation is his investigation. Thus, properly, the candidate is follower and not director of inquiry; he pursues a technique chosen and directed by another; he is executor of a plan not his own. If he plays his part of technical assistant to the satisfaction of the professor, thereby, so far as research enters, he qualifies for the doctor's degree.

(2) A second policy does not admit the candidate to staff research; it assigns him to independent research. The candidate is not an assistant whom the professor may use at his discretion for the forwarding of his own researches; he is, rather, an initiate in self-directed inquiry, for whom the professor is a resource of advice and criticism. His independent research is both a medium for the development of research ability, and a test of that ability. By it he is judged to be competent or not competent in research.

(3) A third policy is intermediate. The policy admits the candidate to a part in execution of more than one professional inquiry, each designed, directed and controlled throughout by the responsible staff member. When the candidate by repeated practice under direction appears to have mastered the essentials of a variously flexible technique, he is released from his auxiliary status and assigned to independent research. Again by his independent work as researcher he manifests his competency or incompetency.

II

Now the end of research is truth discovered. To that end error, so far as is humanly possible, must be kept out of investigations. The obligation of the university in its research function is to maintain the highest quality of truth-seeking that the capacities of its membership and the extent of its material resources permit. Hence research must be directed and controlled by the select and the proven in research—namely, the experienced and competent staff membership.

(1) In the first policy described above, that principle is clearly accepted. There is no research other than staff research. The policy permits, if it does not ensure, the highest attainable quality in all research for which the university stands sponsor.

(2) The second policy segregates staff research from the research of candidates. The staff is in no wise hindered in the most effective use of its resources

for discovery of truth. But the policy does admit a second level of research. For it is neither assumed nor to be assumed that the norm of acceptability in student research shall equal the norm of staff production in research. The standard is, rather, the minimal level of acceptable staff research. Hence, if student research be placed in the same category with staff research, the level of quality in the total research product of the university is lower than it is under the first policy of strict staff responsibility.

(3) The third, or intermediate, policy protects staff research exactly as does the first policy. But, like the second policy, it admits a second level of research. The level of student product, however, is likely to be raised. For the policy involves training in the essentials of technical procedure preliminary to the undertaking of independent research. Hence, the level of total research under university auspices will, in quality, lie between the extremes.

III

The end of the training function is the competent researcher—a man able to locate and define a problem for investigation; able to plan and carry through a technique of inquiry appropriate to the solution of his problem; able to organize and interpret, in their immediate bearings at least, the findings to which his inquiry leads.

(1) The first policy, well designed to the maintenance of quality in research, is deficient as a means to the qualification of the researcher. The candidate is not the original and responsible agent in location and definition of the problem for investigation; nor is he selecter and organizer of the method of attack; nor, again, is he organizer and interpreter of findings. In all those phases of the investigation he is but observer, or, at best, "vicarious participant." He is responsibly active only in execution of technique. That is, his "training" is alongside of research rather than in it. If the candidate has originality he has not demonstrated it. He is trained only as a technical assistant, not as a researcher.

(2) Under the second policy the candidate is placed in the position of the researcher. He must find and define his problem, plan and execute his technique of inquiry, organize and interpret his findings. His participation in research is genuine and not vicarious. He is trained in research by performance of "a complete act" of research.

(3) The third policy, by keeping the candidate in contact with "a complete act" of a competent researcher, provides for him a pattern of research. By repeated practice in certain essentials of technique it trains him in elements of habit usable in research. By assignment to independent research it educates him in "a complete act" of research. The candidate learns both by imitation of research and by genuine research of his own.

IV

It appears, then, that an organization of university function to the end of highest quality in research is not an organization best adapted to the production of the competent researcher. On the other hand, an organization to the end of competency in the researcher is not best adapted to the highest product in research. The functions of research and of training in research are coordinate, but they are not coincident.

Can not the university best serve both ends by a frank recognition of distinction in functions? Let us have in one category research of the highest quality, performed by the experts in research—what I should like to call university research. In another let us have research of high quality, performed by initiates in research, undertaken by the university not for the sake of its value in contributing to the sum of known truth, but undertaken as a means to the development of competency in prospective researchers. This I have, without license, already called student research.

T. H. EATON

CORNELL UNIVERSITY

THE PROMOTION OF KNOWLEDGE OF PRECAMBRIAN LIFE

THE promotion of the knowledge of Precambrian life is the object of an award and medal founded by Mrs. Mary Vaux Walcott, in memory of her late husband, Dr. Charles Doolittle Walcott, internationally distinguished for his investigations of Cambrian life and preeminent in his explorations of Precambrian life. A trust fund providing for an honorarium and inexpensive medal has been established under the auspices of the National Academy of Sciences in accordance with Mrs. Walcott's letter as follows:

I inclose herewith the outline for a medal and honorarium, to be awarded every five years by the National Academy in memory of the work of my husband, Charles Doolittle Walcott. I hope this trust will be acceptable to the Academy and serve to stimulate investigation along the scientific lines which were of such great interest to Doctor Walcott.

The essential provisions governing the award are:

(1) The fund ($5,000) is to be known as the Charles Doolittle Walcott Fund.

(2) The income shall be used for the award of medals and honoraria to persons between the ages of 21 and 48 years, the results of whose published researches, explorations, and discoveries in pre-Cambrian history shall be judged by the Trust Fund Board to be most meritorious. The award shall be made without respect to nation, race, sex, or academic degree.

(3) A medal to be known as the Charles Doolittle Walcott Medal, for the promotion of knowledge of pre-Cambrian life, is to be awarded every 5 years, beginning with 1932, unless in the judgment of the Board no candidate worthy of the award is in view at the end of the period. The medal is to be cast in bronze or some other inexpensive metal and the accrued income in highest even hundreds of dollars is to accompany the medal as an honorarium. The same person shall not receive the medal and prize on two successive periods.

(4) The selection of the recipients is in the hands of the Fund Trustees, whose recommendations are submitted to the Council of the National Academy for approval. The Trustees, 5 in number, are to include the Secretary of the Smithsonian Institution in Washington, *ex officio*, a member to be proposed by and represent the Institut de France, a member similarly representing the Royal Society of London, and two members of the National Academy of Sciences distinguished in Paleozoic paleontology, to be appointed by the President and Council of the Academy.

(5) The awards will be bestowed at annual meetings of the Academy.

An interesting and notable feature of the terms of the gift is the stipulation that it is awarded only to young men and women who have not yet passed the age of forty-eight.

The announcement of the gift of the fund by Mrs. Walcott and of its acceptance by the council of the Academy was made in the session of the Academy on April 23. The formal acknowledgment by the president of the Academy follows:

Permit me, on behalf of the council of the Academy, to express the satisfaction felt by it that you are commemorating the life and work of Dr. Charles Doolittle Walcott by establishing a medal and honorarium bearing his name for the promotion of knowledge of Precambrian life, and also to thank you for your confidence in placing in trust of the Academy this memorial to a distinguished member, who did much to advance its welfare.

The history of Precambrian life runs from the origin of the first living organism to the high development of the lower orders of life found in the early Cambrian, in the study of which Dr. Walcott was for many years pre-eminent. The period covered by this history, during which terrestrial conditions, including seas, lands, sunlight, rains, winds and currents appear to have been favorable for life on earth, may well have been as long or even longer than all time that has elapsed since the first Cambrian sediments were laid down. The story of the sequence of plants and animals during Precambrian time to be told by the actual fossil remains is as yet almost wholly unknown. Most of its pages have been torn away or effaced by mountain building and erosion, or blotted and disfigured beyond hope of discernment by the forces which have produced metamorphism or even complete destruction. Some doubtless now lie buried deeply from sight beneath the strata of later ages, to be revealed, perhaps, by erosion following new revolutions in the course of hundreds of millions of years to come. Only in comparatively few areas, where the sediments, after having first escaped obliterating metamorphism have fortunately escaped erosion or deep burial, can we expect to find surviving fragments of the record which future students may laboriously piece together. In some cases, the records, though offering indisputable proof of life, do not permit the revelation of the structure of the organism and its meaning, just as an old letter, faded and torn, is unquestionably in writing, though it can not now be read. In other cases the student may not for a time understand the language, many of whose characters are nevertheless distinct. Eventually, however, large portions of the history of Precambrian life will be built up, piece by piece, and with it the larger understanding of the conditions, the processes and the contemporaneous products of the evolution of life on earth.

For over thirty years Dr. Walcott was deeply interested in the search in Precambrian formations for the remains of life antecedent to that in the earliest Cambrian with which he was so familiar. His early discoveries in the Appalachian and the southwestern regions paved the way for his later discoveries of the highly varied and impressive organic formations in the Belt series and associated terranes of the Northern Rocky Mountains, which form the nucleus of our greatest contribution to Precambrian life, especially as it is revealed in deposits laid down through the vital activity of different types of plant life. Not only was Dr. Walcott deeply interested in Precambrian life; to his zeal and persistent faith we owe the greater part of our knowledge of it.

It is appropriate that through these awards you seek to stimulate the interest and zeal of young men and women in this field so long cherished by Dr. Walcott, while perpetuating the association of his name with the advancement of knowledge of Precambrian life.

The Academy accepts your trust in this spirit and in homage to your late husband.

As is well known, Dr. Walcott was for many years an active and productive member of the Academy, which through different periods he served as treasurer, councillor, and, not long before his death, as president. He took a leading part in the acquisition of the lands and in securing the funds necessary for the erection of the magnificent home of the Academy and the National Research Council in Washington.

DAVID WHITE

SCIENTIFIC EVENTS

THE AWARD OF PRIZES AND GRANTS BY THE BELGIAN ACADEMY OF SCIENCES

ACCORDING to *Nature*, the following prize awards have recently been announced by the Belgian Royal Academy of Sciences: Maurice Nuyens (1,500 francs), for his memoir on the resolution of problems with axial symmetry in general relativity; A. Monoyer (1,500 francs), for anatomical and ethological researches on one or more plant species interesting through their mode of life; Théophile Gluge prize (1,300 francs), to L. Dautrebande for his work on the study of gaseous metabolism in man in health and disease; P. J. and Ed. van Bereden prize (3,400 francs), to Hans de Winiwarter for his work published during 1924–26; Adjutant H. Lefévre prize (1,500 francs), to Hélène Massart for her researches on the phenomena of secretion in plants; Ad. Wetrems prize (7,500 francs), to Louis Verlaine for his studies on instinct and intelligence in Hymenoptera Agathon de Potter Foundation. The following grants have been made: W. Conrad (2,000 francs), for the continuation of his researches on the lower organisms, particularly on the Belgian fresh-water flagellates; J. Pasteels (500 francs), to continue at Wimereux his researches on the cyto-physiological action of the dilution of sea-water on the eggs of lamellibranchs; the Jean Mascart experimental garden (5,000 francs), to continue a series of experiments on plant physiology commenced by the late Jean Mascart; E. Zunz (6,000 francs), for the purchase of instruments necessary to the continuation of his researches on glycaemia; Th. De Donder (7,500 francs), for the publication of his "Théorie des invariants intégraux"; Gilta (1,000 francs), for the publication of plates of chemical crystallography; E. De Wildemann (3,000 francs), for assisting the publication of parts of volume 4 of "Plantæ Bequærtianæ"; Comité national de Géodésie (5,000 francs), to enable it to print the reports of 1920–25 and 1926, on the geodesic work done by the Institute cartographique militaire since the war; Beeli (500 francs), for the execution of plates relating to the mycological flora of the Congo. Jean Servais Stas Prizes to Lucie De Brouckère, Léon Navez, Louis Henry; the Decennial prize of the mineralogical sciences to Armand Renier.

EXHIBIT OF THE BINGHAM OCEANOGRAPHIC COLLECTION AT YALE UNIVERSITY

THE Bingham oceanographic collection, which consists of over 3,000 items, and which was collected by Harry Payne Bingham, of New York City, has been placed in the Peabody Museum of Natural History at Yale University, and was exhibited in connection with the university's 227th commencement activities. This collection of marine animals, containing over one hundred new species, is so arranged that it may be of utmost benefit to students and the public.

Three oceanographic expeditions by Mr. Bingham and a group of scientists were required to bring together this material. The first expedition visited West Indian waters and the coast of the British Honduras. Efforts were chiefly directed toward making a collection of the less common fishes and other animals in the shallower waters, and of the various organisms which inhabit the sea-bottom to a depth of about three thousand feet. As a result of this expedition, twenty new species of shallow water fishes and seventeen new species of crustaceans from various depths have already been described. The second expedition went to Perlas Islands in the Bay of Panama and the Gulf of California, the latter a comparatively little explored faunistic region. Many valuable items were found there, of which already fifteen species have proved to be new.

The third expedition conducted by Mr. Bingham, considered the most successful of the three, visited the waters about the Bahama and Bermuda Islands. As a result of this expedition, thirty new species have already been described, and it is expected that many more will be found.

About one hundred and twenty fishes representative of the regions visited by Mr. Bingham during his expeditions have been mounted by Francis West, who accompanied him on these expeditions, and whose work is well known in American museums. Wilfred S. Bronson, also a member of the expeditions, has made over fifty oil and water paintings in color of the fishes and other animals as they were taken fresh from the water. In his paintings Mr. Bronson has worked on the relationships of the fishes to each other and to their surroundings, with the result that each picture serves almost as a habitat group. Over one hundred species of fishes are represented in these paintings.

In order that his collection could be studied and the results published, Mr. Bingham has placed in charge of his collections Alfred E. Parr, a Norwegian oceanographer and ichthyologist, who has been appointed to the staff of Peabody Museum as assistant curator of zoology in charge of the Bingham Oceanographic Collection. It is planned not only to continue the taxonomic work but to take up investigations in other important biologic aspects of oceanography.

OKLAHOMA GEOLOGICAL SURVEY FIELD PARTIES

DURING the present summer eight geological field parties will be working in Oklahoma under the direction of the Oklahoma Geological Survey, according to Chas. N. Gould, director.

Professor Charles E. Decker and C. A. Merritt, of the University of Oklahoma, will continue their studies begun last year in the Arbuckle Mountains in southern Oklahoma. A paper recently published by these investigators states that the thickness of the Arbuckle limestone is approximately 8,000 feet. Dr. E. O. Ulrich, of the U. S. Geological Survey, was with this group the first two weeks of June collecting fossils from the Arbuckle limestone.

Professor F. A. Melton, of the University of Oklahoma, will spend two months in the Arbuckle and Ouachita Mountains measuring the tension joints in the formations, and applying the Cloos methods of investigation, in the endeavor to ascertain the relative ages of these two mountain uplifts. Professor W. T. Thom, of Princeton University, assisted by C. W. Miller, will spend three months in the coal fields of eastern Oklahoma tracing coal outcrops of the segregated coal lands of the Choctaw nation.

Professor Joe E. Moose, of the University of Oklahoma, will collect samples of Oklahoma coals and make B. T. U. thermal tests of the same. Paul E. Shelly, of the department of petroleum engineering of the University of Oklahoma, will collect asphalt samples in southern Oklahoma and conduct weathering tests on Oklahoma asphalts. A. J. Freie, of the University of Iowa, will continue his sedimentation studies on the Anadarko basin. G. G. Suffel, of Stanford University, will spend two months in western Oklahoma studying field exposures of the dolomite formations of the Permian red beds preparatory to a report on Oklahoma dolomites. John A. McCutchin is undertaking the work of ascertaining deep well temperatures in Oklahoma, this being part of Research Project No. 25, sponsored by the American Petroleum Institute under the direction of the petroleum committee of the National Research Council.

The results of the various investigations will be embodied in reports to be published by the Oklahoma Geological Survey.

APPOINTMENTS AND PROMOTIONS AT HARVARD UNIVERSITY

AMONG the promotions and new appointments recently announced by Harvard University are the following:

William H. Weston, Jr., professor of cryptogamic botany. Professor Weston has served as a pathologist in the Bureau of Plant Industry, U. S. Department of Agriculture, and during the past year has been associate professor of botany in the university.

Leon W. Collet, professor of geology. Professor Collet was in the geology department of the University of Edinburgh, and later professor of geology at the University of Geneva, before becoming a visiting lecturer at the university in 1927.

Joseph H. Faull, professor of forest pathology. Professor Faull comes from the Department of Botany in University of Toronto.

Joseph C. Aub, associate professor of medicine and physician at the Collis P. Huntington Memorial Hospital. He has been a member of the Medical School faculty since 1920.

Charles H. Berry, professor of mechanical engineering. Since 1925 he has been an associate editor of the magazine *Power* and an assistant professor at Cornell University.

Edwin J. Cohn, associate professor of physical chemistry. Since 1925 he has been an assistant professor in the department.

William L. Aycock, assistant professor of preventive medicine and hygiene. In 1916 he served as diagnostician with the New York State Department of Health, and later as director of the research laboratory of the Vermont Board of Health and instructor in preventive medicine in the university.

Chester M. Jones, assistant professor of preventive medicine and hygiene. Since 1925 he has held the Henry Pickering Walcott fellowship in clinical medicine.

Monroe A. McIver, assistant professor of surgery. In 1921 he was national research fellow in physiology and has been an instructor in surgery in the university since 1924.

John Homans, assistant professor of surgery. Since 1916 he has been an instructor in surgery in the university.

Richard H. Miller, assistant professor of surgery. Since 1919 he has held the position of instructor in surgery.

Robert C. Cochrane, assistant professor of surgery. He has been an instructor in urinary surgery in the university since 1924.

Merrill C. Sosman, assistant professor of roentgenology. He has served as instructor in the Medical School, consulting physician in the Collis P. Huntington Memorial Hospital since 1924.

Clifford L. Derick, assistant professor of medicine. Was recently connected with the Peter Bent Brigham and since 1924 with the Rockefeller Hospital in New York City.

Hermann L. Bhemgart, assistant professor of medicine. He has been connected with the Medical School since 1923 as instructor in medicine.

Derwent Stainthorpe Whittlesey, assistant professor of geography, now associate professor of geography at the University of Chicago.

Harold Coe Stuart, assistant professor of child hygiene. Dr. Stuart has been a member of the department since 1922.

SCIENTIFIC NOTES AND NEWS

DR. M. L. HARRIS, professor of surgery at the Chicago Polyclinic Hospital, was elected president of the American Medical Association at the Minneapolis meeting to succeed Dr. W. S. Thayer, of Baltimore. It was decided to hold the next meeting at Portland, Oregon.

YALE UNIVERSITY has conferred the honorary degree of doctor of science on Dr. C. U. Ariëns Kappers, director of the Central Institute of Brain Research, Amsterdam, Holland, and on Dr. H. E. Ives, physicist of the Bell Telephone Laboratories. The degree of master of science was conferred on Dr. Evarts Ambrose Graham, professor of surgery at Washington University, St. Louis.

DR. BARTON W. EVERMANN, director of the museum of the California Academy of Science; Professor Aldred Scott Warthin, head of the department of pathology of the University of Michigan, and Dr. John A. Miller, astronomer, and vice-president of Swarthmore College, all graduates of the University of Indiana, were among those receiving honorary degrees at the ninety-ninth annual commencement exercises at the university on June 11.

THE honorary degree of doctor of laws was conferred upon Dr. Henry Fairfield Osborn, president of the American Museum of Natural History, at the annual commencement exercises of Union College, on which occasion Dr. Osborn gave the principal address.

PROFESSOR ALBERT R. MANN, dean of the college of agriculture at Ithaca, and Professor Samuel T. Dana, dean of the College of Forestry at the University of Michigan, received honorary doctorates of science at the fifty-seventh annual commencement exercises of Syracuse University.

THE honorary degree of doctor of science was conferred on Chas. N. Gould, director of the Oklahoma Geological Survey, by the University of Nebraska at the commencement on June 2.

THE president of the French Republic has conferred the cross of officier de la Légion d'Honneur on Dr. George H. F. Nuttall, Quick professor of biology in the University of Cambridge.

AMONG those honored on the occasion of the birthday of the King of England are Professor J. H. Jeans, secretary of the Royal Society, who has been knighted, and Professor J. S. Haldane, honorary professor of mining at the University of Birmingham, who has been appointed to the order of the companions of honor.

AT the anniversary meeting of the Royal Society of South Africa on March 31, Dr. W. A. Jolly, professor of physiology in the University of Cape Town, was elected president. Dr. A. Ogg, professor of physics in the University of Cape Town and retiring president of the society, was elected honorary general secretary, and Dr. L. Crawford, professor of pure mathematics in the University of Cape Town, honorary treasurer.

AT the annual meeting of the Harvey Society held on May 16 the following members were elected to serve as officers for the coming year, 1928–1929: *President,* Dr. Peyton Rous, of the Rockefeller Institute; *vice-president,* Dr. Horatio B. Williams, Dalton professor of physiology, Columbia University; *members of the council,* Dr. Robert Chambers, professor of microscopic anatomy, Cornell University Medical School; Dr. Harold D. Senior, professor of anatomy, New York University and Bellevue Hospital College; Dr. Alfred F. Hess, clinical professor of pediatrics, New York University and Bellevue Hospital College; *secretary,* Dr. Philip D. McMaster, Rockefeller Institute.

AT the meeting of the American Association of Pathologists and Bacteriologists held at Washington, D. C., on May 1, the following officers were elected for the ensuing year: *President,* E. B. Krumbhaar; *vice-president,* George H. Whipple; *secretary,* Howard T. Karsner; *treasurer,* F. B. Mallory, and incoming *member of council,* Ward J. MacNeal. The next meeting of the association will be held in Chicago on March 28 and 29, 1929.

THE American Society of Experimental Pathology has elected the following officers for the ensuing year: *President,* E. B. Krumbhaar; *vice-president,* W. F. Peterson; *secretary-treasurer,* C. V. Weller. The next meeting will be held in conjunction with the International Congress of Physiology in Boston in August, 1929.

DR. FORMAN T. MCLEAN has resigned from the staff of the Experimental Station of Rhode Island State College, to accept the position of superintendent of public education at the New York Botanical Garden.

LLOYD S. TENNY, chief of the bureau of agricultural economics of the U. S. Department of Agriculture, has resigned to take a position with the Associated California Fruit Industries.

WILLIAM NEWTON has been appointed plant pathologist for the Dominion Department of Agriculture in British Columbia.

DR. HARLAN T. STETSON, assistant professor of astronomy at Harvard University, has been appointed exchange professor to western universities for the second half of the next academic year.

DR. W. F. MEGGERS, chief of the spectroscopy section of the U. S. Bureau of Standards, has left for

Europe, where he will represent the bureau at the meetings of the International Astronomical Union in Leyden, Holland.

DR. EMANUEL G. ZIES, of the geophysical laboratory of the Carnegie Institution, is proceeding to Java to engage in research in connection with volcanic activity.

DR. ROBERT L. PENDLETON, soil technologist in Los Banos College, Philippines, has recently been granted three months leave in order to visit various colleges and experiment stations in the Orient. After two weeks in Tokyo he went north to Morioka and Sapporo, then down the west coast and to Kyoto, Nagoya and Fukuoka. On the homeward trip he expects to stop in Formosa and at Canton Christian College.

DR. PAUL BARTSCH, curator of mollusks of the U. S. National Museum and holder of the Walter Rathbone Bacon research scholarship, will spend the next four months in Cuba, where he will be joined by Dr. Carlos de la Torre, president emeritus of the University of Havana, on a search for salt and freshwater mollusks.

DR. E. O. ULRICH, paleontologist of the United States Geological Survey, is spending a month in Missouri, Arkansas and Oklahoma collecting fossils from the lower Paleozoic formations in these states. The information obtained will be embodied in a report which Dr. Ulrich is now writing on the Paleozoic formations of the Arbuckle Mountains of Oklahoma.

DR. IRVINE H. PAGE will sail in August for Munich, Germany, where he will be a guest research worker and physician to the Kaiser Wilhelm Anstalt Forschung under the directorship of Professors Willstätter and Plaut.

WILLIAM BEEBE, of the New York Zoological Society, has returned from a month's visit to England, where he went to study the deep-sea fish in the British Museum and to complete certain portions of his ichthyological library. He gave several addresses on his diving work on the coral reefs of Haiti, including one before the Zoological Society of London.

PAUL S. MARTIN, curator of archeology and ethnology at the museum of the Colorado State Historical Society, has returned from his second season in Yucatan as assistant archeologist for the Carnegie Institution of Washington. While in Yucatan he excavated and completely restored a Mayan temple. He is planning to do some excavating for the State Historical Society in the southwestern part of Colorado during July and August.

FREDERICK G. CLAPP has completed a reconnaissance in southern and western Persia and eastern Iraq and has returned to Teheran.

DR. W. M. DAVIS, emeritus professor of geology at Harvard University, lectured on "The Coral Reef Problem" before the Sigma Xi of the University of Arizona at Tucson on May 26, and on May 30 delivered the commencement address on "The Value of Useless Knowledge" at the same university, where he has been lecturing on physiography through the spring term. On June 3 he conducted a field meeting of the Rift Club of Southern California at the base of the dissected fault-scarp which limits the San Gabriel mountains on the south near Pasadena.

DR. R. J. GARBER, head of the department of agronomy and genetics at West Virginia University, gave two lectures at the eighth annual convention of the Canadian Society of Technical Agriculturists, which was held in Quebec, June 11 to 14, inclusive. The subjects of the lectures were "Breeding for Disease Resistance with Particular Reference to the Smut of Oats" and "The Nature and Significance of Mutations in Present-day Breeding Methods."

DR. R. W. THATCHER, president of the Massachusetts Agricultural College, will give an evening lecture at the Institute of Chemistry of the American Chemical Society, July 27, on "The Development of Agricultural Research."

THE following lectures have recently been given at the physical laboratory of the University of Minnesota: Professor Léon Brillouin, of the University of Paris, lectured on May 14 on "Quantum Statistics" and "Recent Developments in Quantum Theory." On May 16, Dr. G. Cario spoke on "Recent Work on Collisions of the Second Kind." On May 25 and 26 Professor Kramers, of the University of Utrecht, gave lectures on "The Uncertainty Principle in Quantum Theory," "The Anomalous Refraction of X-rays," and "The Quantum Theory of the Electron."

AT the annual graduation exercises at Clark University a scholarship as a memorial to the late Dr. Edmund C. Sanford, psychologist, former president of the university, was presented by the alumni, and a portrait of the late Professor William Libbey, of Princeton University, was presented by Dr. W. Elmer Ekblaw, representing Mrs. Libbey.

A MARBLE bust of the late John Collins Warren, done by J. F. Paramino, will soon be placed in the Warren anatomical museum at the Harvard Medical School.

SAMUEL B. PARISH, honorary curator in the herbarium of the University of California and lecturer in Stanford University, died on June 5, aged ninety years.

THE *Experiment Station Record* notes the death on March 7 of Dr. Hjalmar von Feilitzen, one of the

leaders in agriculture and agricultural research in Sweden.

DR. CHARLES PLATT, emeritus professor of biological chemistry in the Hahnemann Medical College, Philadelphia, has died at the age of fifty-nine years.

THE Northern Arizona Society of Science and Art has been founded to increase and diffuse both the knowledge and appreciation of science and art, to protect historic and prehistoric sites, to protect scenic places, and conserve vanishing wild life. The society will maintain in the city of Flagstaff a museum where the archeological and ethnological treasures of Northern Arizona can be displayed and where the geological wonders of the plateau can be interpreted. Dr. Harold S. Colton is the director of the museum. A board of fifteen trustees has been appointed.

THE twentieth annual meeting of Poultry Science Association will be held from August 21 to 24, at Purdue University, Lafayette, Indiana. The annual meetings are largely attended by extension, teaching and research workers, who devote most of their time to poultry science, of various state universities, experiment stations and state departments.

THE executive committee of the International Geodetic and Geophysical Union has voted to hold the next meeting of the union at Stockholm, Sweden, between the dates, August 18–25, 1930.

AN Empire Forestry Conference will open in Perth about the first week in September, and delegates will spend six weeks in Australia, the last week being occupied in Canberra. They will spend three days in each state inspecting forestry activities.

THE Institution of Civil Engineers began on June 4 the meetings associated with the celebration of the centenary of its incorporation by royal charter. The inaugural ceremony took place in the hall of the institution, Great George Street, Westminster, when the president, Mr. E. F. C. Trench, welcomed delegates from various parts of the world, many of whom presented addresses of congratulation. In addition to engineering, scientific and professional societies and universities in the British Isles, there were representatives present of kindred institutions in Canada, South Africa, Australia, New Zealand, India, Austria, Chile, Czechoslovakia, Denmark, France, Germany, Holland, Italy, Japan, Norway, Portugal, Sweden, Switzerland and the United States.

WE learn from *Nature* that by the will of Lieutenant-Colonel A. J. C. Cunningham, who died on February 8, the London Mathematical Society will receive £1,000 for the improvement of the method of factorization of large numbers, and £2,000 for the publication of Colonel Cunningham's unpublished printed mathematical works and the completion and publication of his mathematical manuscripts, and also his library of mathematical books. The residue of his estate is to be divided as to one twelfth to the London Mathematical Society, and one twelfth to the British Association, mathematical subsection, for preparing new mathematical tables in the theory of numbers.

THE Chilean Nitrate of Soda Educational Bureau has offered an annual award of $5,000 to research workers in North America for outstanding research that will contribute to the fund of knowledge regarding nitrogen in crop production. The award is sponsored by the American Society of Agronomy, of which P. E. Brown, Iowa State College, Ames, Iowa, is secretary-treasurer.

THE board of regents of the University of Wisconsin have accepted a fund of $15,000 by a Wisconsin group of foundries for metallurgical research in the college of engineering. The fund provides $5,000 a year for three years for equipment to carry on the experiments.

THE Johns Hopkins University has received $500,000 from an anonymous donor to complete the endowment of the Welch Medical Library. An anonymous donor also gave $100,000 to the Wilmer Clinic, subject to an annuity.

TWO donations of $200,000 each by John D. Rockefeller, Jr., and James Speyer have sent the building fund of the Museum of the City of New York over the $2,000,000 mark. This assures the museum the city-owned plot of land at 103rd St. and 5th Ave.

THE formal opening of the new museum building at the University of Michigan took place on June 14.

THE important collection of diatoms assembled by the late Charles S. Boyer has been presented by Mrs. Boyer to the Leidy Microscopical Club of the Academy of Natural Sciences of Philadelphia, together with Mr. Boyer's complete library covering the literature of the Diatomaceae. The collection contains over six thousand slides with a card catalogue, includes many types, and embraces practically all the material studied by Mr. Boyer in preparing his "Synopsis of the Diatomaceae of North America," recently published by the Academy of Natural Sciences of Philadelphia.

THE University of Virginia has announced a gift from the General Education Board of $175,000, to be expended within a period of seven years in support of research in biology, chemistry and physics. Research fellowships, open to properly qualified grad-

uate students, have been established in each of these subjects. A number of fellowships at $1,000 each are still available for 1928–29 in the schools of biology and chemistry. Applications should be addressed to the secretary of the appropriate department.

THE new Daniel Guggenheim aeronautical laboratory at the Massachusetts Institute of Technology was formally dedicated and opened for use on June 4.

THE three-story science building of St. Leo's College in Florida was destroyed by fire on June 1, the damage being estimated at $35,000.

AGASSIZ MUSEUM, the Harvard University museum of comparative zoology, was opened again to the public, beginning June 19, following the first extensive remodeling it has had in fifty years. The museum has been closed for about six months while repairs were being made. During the past six months the whole museum has been redecorated and repainted; the building has been entirely renovated. Several old collections which were deemed unsuitable for further exhibition have been discarded and all the exhibits have been rearranged. Several exhibits, new to the university, have been prepared, one being a hall of oceanic mammals, another one of domesticated animals and others designed to show heredity and the variation of animals under domestication.

PRESIDENT COOLIDGE has by executive order reestablished for the protection of native birds the Pathfinder Bird Refuge, embracing 22,700 acres on the North Platte River in central Wyoming, according to an announcement by the U. S. Department of Agriculture. The area is set aside as one of the numerous refuges administered by the Bureau of Biological Survey.

To exchange ideas with the leaders of forestry and outdoor life in Europe and to study the problems of European forests, a group of members of the American Forestry Association, Washington, and others vitally interested in forests, parks and wild life sailed from New York on June 30. The tour will include France, Germany, Switzerland, Finland and Sweden.

UNIVERSITY AND EDUCATIONAL NOTES

ESTABLISHMENT of a trust fund of between $5,000,000 and $6,000,000 for the University of Virginia has been announced by President Edwin A. Alderman. The money was given by an anonymous donor. Half of the income from this fund is to be used for the establishment of scholarships and fellowships, and the remainder for the general educational purposes of the university.

BOWDOIN COLLEGE received over $1,000,000 in gifts during the last year. This includes a $250,000 bequest from F. A. Munsey; $150,000 from the estate of Thomas Upham Coe, of Bangor, Me., and $50,000 from David Pingree, of Salem, Mass.

THROUGH the generosity of an anonymous donor interested in the subject of chemical education a professorial chair in this field has been endowed for the immediate future in the Johns Hopkins University, and Dr. Neil E. Gordon has been elected to the position. Dr. Gordon is at the present time head of the department of chemistry at the University of Maryland and state chemist.

DR. CHARLES F. HOTTES, professor of plant physiology at the University of Illinois, has been appointed professor of botany and head of the department to succeed Dr. H. L. Shantz, who becomes president of the University of Arizona.

DR. F. D'HERELLE, director of the bacteriological laboratory at Alexandria, Egypt, has been appointed professor of bacteriology at Yale University. Dr. d'Herelle was born in Montreal and still retains his Canadian citizenship. He will arrive in the United States about September 1.

PROMOTIONS and appointments on the faculty of the Massachusetts Institute of Technology have been announced. Those promoted from the grade of associate professor to full professorships include: John B. Babcock, professor of railway engineering; J. W. M. Bunker, professor of biochemistry and physiology; H. H. W. Keith and George Owen, professors of naval architecture; Charles Terzaghi, professor of foundations, and Clair E. Turner, professor of biology and public health.

DEAN EDWARD H. ROCKWELL, of the College of Engineering, Rutgers University, has been appointed professor of civil engineering in Lafayette College.

ROBERT L. SPENCER, chief engineer of the McAleenan Corporation of Pittsburgh, has been elected dean of the department of engineering of the University of Delaware, to succeed the late Professor V. G. Smith.

DR. E. D. RIES, director of the division of industrial research in the school of chemistry and physics at the Pennsylvania State College, has resigned to give all his attention to his duties as head of the chemical engineering department, he having filled both positions for the past year. Dr. William J. Sweeney, formerly of the chemistry faculty and for the past two and a half years at the Massachusetts Institute of Technology, has been appointed assistant professor of research and director of the division.

AT the University of Edinburgh, Dr. F. A. E. Crew has been appointed professor of animal genetics and director of the university department of research in animal breeding. The chair, which is to be known as the Buchanan chair of animal genetics, was founded by a donation from Lord Woolavington, supplemented by a grant from the International Education Board.

DISCUSSION AND CORRESPONDENCE

RESEARCH PLUS NEWS-GATHERING

ALTHOUGH not primarily a research institution, Science Service is now contributing in a small measure to the advancement of science.

In some instances it is possible to combine a certain degree of research with the news-gathering activities of the Service. The most successful instance to date is the earthquake reporting service that Science Service organized and conducts with the cooperation of the leading seismological observatories, the U. S. Coast and Geodetic Survey and the Jesuit Seismological Association. This system serves the needs of seismologists as well as newspapers. During the year ending March 31, 1928, twenty-seven earthquakes were located and reported through this service. As many as eighteen seismological observatories, some as far away as Alaska and the Philippines, have cooperated. Whereas before the inauguration of this service scientists and the public were often in ignorance for weeks as to the location of many earthquake epicenters, now practically every shock of any importance is located within six to twenty-four hours. We often locate disastrous earthquakes, and predict loss of life that occurred, days and weeks before the news reaches the world through the routine news channels. When the Bulgarian city of Philippopolis was destroyed on April 18, Science Service reported the earthquake early the next day, stating the probability of disaster, while the cables did not carry the news until April 21. On April 10 our instrumental data located a severe earthquake in eastern Peru; a week later on April 17 the news came from the region itself. On May 23, 1927, a severe earthquake in Kansu Province, China, was recorded, and Science Service announced its exact location and predicted heavy loss of life. Not until the latter part of July, two months later, did the confirmation of this great disaster filter out from the interior of the yellow continent.

This combination of research and news activity is now being extended to the fields of anthropology and archeology.

It is very important to be able to send to the spot of the alleged archeological find a competent investigator. Prompt action is necessary from the point of view of anthropology because of the liability that evidence as to the character of the discovery of its geological position or the indications of the age of the deposits may be forever destroyed by careless excavators or faked relics; and from the point of view of Science Service because it is our job to see that exaggerated and misleading reports do not get the start of authentic news. To meet such emergencies we proposed to cooperate with the department of psychology and anthropology of the National Research Council by offering to provide funds sufficient for the preliminary inspection of the find if we were supplied with a list of authorized "scientific minute men" located at strategic points all over the country to whom we should be at liberty to wire for advice in cases of disputed questions. If plans for action are made in advance they might, without delaying to consult us, take train or automobile at once to the place where a prehistoric inscription or the bones of an antediluvian giant has been reported.

The division of anthropology and psychology of the National Research Council has authorized cooperation with Science Service in this undertaking and will arrange with us in preparing such a list of anthropologists and other specialists who will wire us at our expense directly from the field. This obviously requires cooperation with geologists, paleontologists, archeologists and ethnologists. By taking measures for the prompt preliminary investigations we may forestall such squabbles as those of the French savants over the alleged Glozel finds.

The volcanoes of the world will be watched as carefully and thoroughly as the earthquakes, if our plans for cooperation between Science Service and the section of volcanology of the American Geophysical Union materialize.

A committee of the section of volcanology was authorized at the recent meeting of the American Geophysical Union to work out methods of cooperation.

The volcano observatories in this country and abroad, scientists who have paid particular attention to volcanoes and who live in their vicinity and others will be invited to participate in a volcano reporting organization by means of which accurate and prompt information on volcanic activities will be obtained by wire and cable, supplemented by mail reports. It is also planned to bring together historical data upon known active volcanoes which will be of service to both newspapers and scientists. Volcanologists have expressed themselves as feeling that this service will aid their science as effectively as the earthquake reporting service of Science Service has aided the science of seismology.

Science Service desires to extend in the future such combined news-gathering and research activities, and we should like to receive from scientists and scientific

bodies suggestions for other such cooperative investigations.

EDWIN E. SLOSSON
WATSON DAVIS

SCIENCE SERVICE,
WASHINGTON, D. C.

AGRONOMIC JABBERWOCKY

WHO among us has not thrilled to Lewis Carroll's sonorous and gruesome lines:

> Twas brillig and the slithy toves
> Did gyre and gimble in the wabe
> All mimsy were the borogoves
> And the mome raths outgabe.

Now after these many years the jabberwock has been aroused again and with eyes of flame is whiffling through the tulgey wood and burbling as he comes:

> The rugaplanes in thickth midlux
> Midodored in the coolth
> But straighth and plumpth the illth umblux
> Midceptisist in fulth.

The new ululations of this fearsome beast are not neglected *Dodgsoniana* resurrected by the antiquarians. They are the grotesque inventions of three moderns who, if not so mellifluous as Dr. Dodgson, are almost as whimsical.[1]

Incomprehensible though it may be, these present fantasies of sounds are not intended as poetic amusement for adolescents. They are offered in all seriousness as aids to American agronomists who, it appears, are struggling perspiringly to be articulate in the refractory English language. That these etymological freaks are welcome is evidenced by the approval with which they were accepted at the Chicago meeting of the agronomists. Presumably hereafter these scientists are to seek lucidity in a ludicrous lexicon of such words as midceptimmune, thickth, plumpth, straighth, midgoodth and rugaplane.

There may be those who will espy the Machiavellian hand of "Big Bill" in this attempt to besmirch the King's English, but that the act took place in Chicago is believed to be the purely fortuitous result of more deep-seated genetic causes.

Proceeding apparently on the theory that the case of the agronomists required heroic treatment the committee on terminology made a herculean effort. The energetic chairman distinguished himself in linguistic prestidigitation, pulling monster after monster out of his hat to be added to a language already reputed to contain 50,000 (or is it 500,000?) words. Whichever the correct number, there surely are enough to meet all the rhetorical requirements of the agronomists, once they have been thoroughly mastered.

It is true that agronomic literature like that of most sciences is open to criticism, but the defect is to be found in the lack of a facile command of the language rather than in a shortage of suitable words. Since "the ultimate aim of research is publication,"[2] inability to express one's thoughts fluently is a fault worthy of most serious study. Any sensible effort to discover a corrective should be welcomed, but an effective cathartic for costive minds hardly is to be obtained by compounding new words, however bizarre. The hapless agronomists have fallen upon evil times and are not likely to find an alleviating diagrydium in the upas shadow of Dr. Ball's Carrollian pastiche.

One can not but be astonished at the egotistic effrontery of a group of men who, after a few weeks' consideration, attempt to improve a language which has met the test of world-wide use for so many centuries. English speech lacks median terms? Forsooth they shall be supplied and presto with a flourish of the pen these diaskeuasts create a veritable Walpurgis of words.

Their words tell us precisely nothing. Objects may be large, small or middle-sized, like the three bears in the nursery tale, but these terms are recognized as being purely relative. They have no meaning in the discrete units of quantity nor should they have. As with general size so with other qualities; things may be tall or short, stout or slender, broad or narrow, deep or shallow, dark or light, straight or crooked, just as committeemen may be wise or foolish, profound or superficial, inferior or superior, grave or comical, sharp or dull, sensible or silly, brilliant or stupid. In fact, there is an almost interminable number of words designating opposite extremes of variable scales. For the positions between the extremes there is an appropriate series of qualifying words such as intermediate, middle, normal, medium, moderate, partial, semi, ordinary, etc. These terms are useful in describing general conditions but are always relative to each other and require definition anew with each discussion where some specific limit is intended.

Not satisfied with having words for the extremes and middle, Dr. Ball's committee is now urging a whole series of new words to mark the quarter positions! These new words, formed by combining adjectives and nouns, are required, presumably, for ac-

[1] Ball, C. R., Shantz, H. L., and Shaw, C. F. "Median Terms in Adjectives of Comparison." *Jour. Amer. Soc. Agronomy*, Vol. 20, No. 2, pp. 182–191. February, 1928.

[2] Allen, E. W. "The Publication of Research." Lecture before the class in "The Nature and Method of Research." Graduate School, Department of Agriculture. Published in mimeograph form for the information of the staff of the Department of Agriculture, February 11, 1925.

curacy of expression, but are likely to create more mental obfuscation than they dispel.

Perhaps the agronomists need a few distinctive terms to add dignity to their science, but the chairman of their committee is not content to restrict his changelings to agricultural science.[3] He seems to feel that his "words" deserve a more widespread popularity and will fill a need in the language at large. The ignominious fate of simplified spelling has been forgotten; a reform justified by sound logic and sponsored by the indefatigable Roosevelt with the full weight of his dynamic personality.

Apparently the agronomists are no longer content to permit the cultured to determine good usage in American speech. Hereafter these matters are to be more democratically decided. The ignorant minority must prevail in language as in politics, and illiteracy is to displace culture. This is an innovation and if we accept agronomic canons of good taste there is no logical reason for rejecting pathological or genetic canons, or for that matter amalgamated truck-drivers' canons. If the agronomists are successful in having their orthographic solecisms incorporated in the respectable dictionaries we may expect similar minority domination from all quarters and our language will become the plaything of irresponsible committeemen.

Nothing could be more absurd than such an arbitrary method of adapting a language to changing conditions. Culture ever has been identified with intellect and never will be achieved by means of the ballot despite the cajoleries of these modern Malaprops with their complacently acquiescent organizations.

All work and no play is detrimental even in matters scientific, but the agronomists, having had their little excursion behind the looking-glass, should now take their vorpal swords in hand and slay the jabberwock. They can then return contentedly to a consideration of their researches, secure in the knowledge that the elegance of their published reports will not be marred with pleonasms imposed by philological mountebanks.

J. H. KEMPTON

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NOTE ON THE INERTIA DYADIC

FOR the dynamics of a rigid body it has been shown that the moment of momentum may be expressed as the scalar product of a dyadic—called the inertia dyadic—and the angular velocity. The inertia dyadic is defined by the relation

$$\Phi = \Sigma m(\mathbf{r} \cdot \mathbf{r}\mathbf{I} - \mathbf{r}\mathbf{r})$$

Thus, it plays the same rôle for rotational motion as the mass for translational motion. There is an important difference, however. Whereas the mass is assumed constant, the dyadic is not constant and as a consequence it becomes necessary to obtain its time-derivative.

Starting with the expression given above it can be shown that

$$\dot{\Phi} = \mathbf{p} \times \Phi - \Phi \times \mathbf{p}$$

in which $\mathbf{p}$ is the angular velocity. This shows, as was to be expected, that the time-rate of change of the dyadic is due only to the angular velocity. The form, however, is not so simple as in the case of vectors and I am not aware that any one has ever taken the trouble to express the derivative in this way. The expression is useful as a step in the development of rotational dynamics, for when taken in conjunction with the fundamental principle

$$\frac{d(\Phi \cdot \mathbf{p})}{dt} = \mathbf{L}$$

Euler's equations for rotational motion are obtained immediately.

I. F. MORRISON

UNIVERSITY OF ALBERTA

A NEW AMPHIBIAN RECORD FROM KANSAS, HYLA PHAEROCRYPTA (COPE)[1]

IN the spring of 1925 a specimen of tree-frog was collected near Wildcat Creek, west of the Kansas State Agricultural College at Manhattan, Riley County, Kansas. It differed from any that had been taken in the region and in life somewhat resembled *Hyla crucifer* because its irregular and asymmetrical dorsal markings tended to form a cruciform pattern.

Later the specimen was sent to the U. S. National Museum for identification and was kindly identified as *Hyla phaerocrypta*. Because of the close resemblance of this species to other members of its genus I did not include this report in my list of the amphibians and reptiles of Riley County (1927),[2] but held it for further study. The specimen was consequently sent to Dr. G. K. Noble, who independently agreed with the previous identification.

Hyla phaerocrypta is an amphibian of unusual interest. It was described by Cope (1889)[3] from a

[3] According to the *Jour. of the Amer. Soc. of Agronomy*, for December, 1927, the case for general adoption of these new words is to be presented in "American Speech."

[1] Contributions from the zoological laboratory of the University of Michigan.

[2] Burt, Charles E., 1927, "An Annotated List of the Amphibians and Reptiles of Riley County, Kansas," Occas. Pap. Mus. Zool. Univ. Mich., 189: 1–9.

[3] Cope, E. D., 1889, "The Batrachia of North America," Bull. U. S. Nat. Mus., 34: 1–515.

single specimen from Mount Carmel, southeastern Illinois, as a subspecies of *H. versicolor*. Mount Carmel still remains as a northern record for the form. Viosca (1923)[4] has reported it from Mandeville, southeastern Louisiana, and has removed its subspecific classification. He has found that the size averages about one and a quarter inches and that the body is generally smaller than that of *H. versicolor*. Both Viosca and Ridgway (1924)[5] have called attention to the bird-like notes of *H. phaerocrypta* and its great difference from the croak of *H. versicolor*. An eastern point in the distribution of *H. phaerocrypta*, namely, Nashville, central Tennessee, has been given by Dunn (1927),[6] and I believe that this present paper sets a western record.

For the purpose of comparison the Kansas specimen (Univ. Mich. No. 65029) and an adult *H. versicolor versicolor* (Univ. Mich. No. 65018) from Cheboygan County, Michigan, have given data for the table below.

Measurement	*H. phaerocrypta*	*H. v. versicolor*
Width of head	11 mm	17 mm
Length of body	35 mm	48 mm
Length of arm	17 mm	23 mm
Length of foot	49 mm	65 mm

The dimensions given above not only illustrate the size-difference of the two forms, but also show the close similarity in their bodily proportions.

CHARLES E. BURT

UNIVERSITY OF MICHIGAN

GEOLOGIC AGE BY LEAD URANIUM RATIOS

DR. KIRSCH has kindly called my attention to a slip I made with regard to the atomic weight of the lead determined by Richards and Hall from the Etta Mine at the Black Hills, South Dakota.

The result was 206.07, and I suggested that to get the atomic weight of uranium lead .05 should be subtracted, whereas, allowing for the slower decay of thorium, it should be .02, making the atomic weight of uranium lead 206.05, practically the same as had been found before.

May I take the occasion to say that at the recent meeting of the committee on the estimation of geologic age by atomic disintegration Dr. Fenner reported some analyses of Brazilian minerals from the same pegmatite which checked remarkably well as to age, one contained mainly thorium and the other mainly uranium. Also Dr. R. C. Wells had obtained from the Upper Cambrian Swedish Kolm the lead: uranium ratio .056, which perhaps means that the upper Cambrian is twice as old as the lower Permian, though final results can not be obtained until the atomic weight of the lead upon which Bliss is working in Professor Baxter's laboratory is determined.

ALFRED C. LANE

[4] Viosca, Percy, 1923, "Notes on the Status of *Hyla phaerocrypta* Cope," *Copeia*, 122: 96–99.

[5] Ridgway, Robert, 1924, "Additional Notes on *Hyla phaerocrypta* (?)," *Copeia*, 128: 39.

[6] Dunn, E. R., 1927, "*Hyla phaerocrypta* in Tennessee," *Copeia*, 162: 19.

DATUM, DATA

DOWN in sunny Buenos Aires,
They call a vamp *patata*,
They speak *la lengua español*,
And insist upon *la data*.

But up in bleak New England,
Not quite so cold as Etah,
They follow Webster's unabridged,
And intonate it *dayta*.

Barbarians out in Arkansaw
Care not to whom they cater,
Any old parlance goes with them,
They call it simply *dayter*.

Some reckless folks in other climes,
Disgracing Alma Mater,
When questioned on their own research
Reply, "I'm accumulating *dater*."

Then, there's the chap, who should be shot,
(His ré-search doesn't matter)
Who every time he opes his mouth,
Talks about his *dătta*.

And last we treat the hopeless guy,
If he doesn't know better he oughta,
Who in spite of profs and courses and books
Still pronounces it *daughta*.

So with *dayter, dayta, dătta*,
And with *data, daughta, dater*,
No matter where the mean may lie,
Statistically, there's too much scatter.

I don't know what in h—l to do
In this seeming simple matter;
But so long as God will grant me breath
I'll never call it *dătta*.

F. E.

SCIENTIFIC BOOKS

Comparative Meteorology, Manual of Meteorology, Vol. II. By SIR NAPIER SHAW, with the assistance of ELAINE AUSTIN. Royal 8vo, 225 illustrations. pp. xl + 446. Price $10.00. Cambridge University Press. Macmillan, Agents in United States.

WHEN Sir Napier Shaw retired from the directorship of the Meteorological Office he set himself the task of preparing four volumes covering the general field of what we now call *Airgraphics*. This volume, although numbered as the second, is the third to appear; and, good as the others were, we are inclined to think this much better. Encyclopedic is the proper term to describe it. There is to begin with a dictionary of technical terms from "absolute" and "adiabatic" to "vortex" and "waves"; and those of us who teach thank him for such an aid to memory. Under "Lest We Forget" are definitions of symbols; and Heaven be praised a given letter stands for one and the same quantity throughout.

Furthermore, conversion tables are given in convenient places, for example, in entablatures with the maps. The result is that a student clearly visualizes the layout; and then, with systematic units, can proceed to tackle his problem without cluttering his desk with an armful of reference books. Will not future text-book writers take the hint? Before one undertakes to prepare a text-book, he should have a clean-cut conception of the physical quantities and processes that are operative. An indiscriminate use of symbols not only baffles the student, but may often trap a tired teacher. The detail of the auxiliary conversion tables deserves much credit. For example, if one wants to know the equivalent in a twenty-eight-, twenty-nine-, thirty-, thirty-one-day month of an annual rainfall of 70 mm., it is given to the third decimal place. Or if one wants at a glance the swing of the pressure over the northern hemisphere, the fine-print heading the chapter on pressure and wind explains a graphic integration of monthly charts of normal pressure; and one easily grasps the situation as a sine curve which follows the curve of total power of solar radiation over the hemisphere with a lag of twenty-seven days. Thus a generalized representation of what otherwise would require a treatise is given in a few lines. Subject to a correction of not more than five per cent. for air displacel by mountains, the mass of air on the Northern Hemisphere varies from its mean value by

Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
+0.1	1.7	4.2	5.1	4.4	1.7	0.3	metric ton × 10^{12}
May	Jun.	Jul.	Aug.	Sept.			
−1.6	4.2	5.1	4.1	2.5			

This is just one of many such treatments. The book is full of condensed data, the meat of each nut without much shell. Because of this new volume, reference books on a five-foot shelf within reach will no longer be consulted by this reviewer, as of yore. In his opinion it enables one who lacks easy access to a large library to meet on equal terms those who are thus fortunate. It may or may not have occurred to Sir Napier and to those who helped him (it was of course impossible for any one man to compile, assemble and analyze all the data which of necessity had to be licked into shape; and Sir Napier fully acknowledges the services of many coworkers, especially Austin, Harding, C. E. P. Brooks, Captain Brunt, Commander Garbett and the staffs of various official organizations) that they have laid the corner-stone of a coming all-important applied science. It is a strange thing that college presidents, with few exceptions, have been sound asleep concerning the need and value of instruction in *airgraphics*, heretofore rather disjointedly called meteorology, climatology, aerology, or physics of the air. Surely no college graduate can regard himself as an intelligent member of society, if he does not know something of the major circulations of the atmosphere and a little about minor circulations and the physical processes involved in the "endless making and unmaking of weather," to borrow from Professor James. Our college presidents concern themselves greatly with modern methods in education and talk at much length of this, that and the other need; but it seems never to have occurred to them that a chair of *airgraphics* is now much more needed than any existent chair. To say nothing of constant application to all phases of human industry, such a course of study would offer the student a tremendous intellectual stimulus. For the field is developing at an astonishing rate. To-day "the air's the thing!" and man is mastering his environment. He realizes at last that while he walks on the ground and sails the seas, he *lives in the air*. Here is high adventure for both brain and hand. So, then, every instructor in any of the sciences dealing with man in relation to his environment, must, if he would keep abreast of the times, read and profit by the information contained in this manual.

Needless to say, the University Press at Cambridge has done its best on this volume. The type work, the legends, the distribution of matter on the page, are all such as might be expected from master craftsmen. Doubtless the text came to them in excellent shape; but it lost nothing at the hands of those who gave it permanent form and dress.

Sir Napier Shaw must feel a large measure of satisfaction as he nears the completion of a work that is truly monumental. What younger man of our generation could have carried on so valiantly?

ALEXANDER MCADIE

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READVILLE, MASS.

REPORTS

INTELLECTUAL COOPERATION AND BIOLOGY

SINCE its early days, the League of Nations has devoted attention to problems concerning the organization of intellectual life, apart from the political activity with which it is more commonly associated in the mind of the general public.

In 1922 an International Committee on Intellectual Cooperation was especially established for this purpose, composed of well-known men and women from the world of science, art and literature, and of which the late Professor Lorentz, the world-famous Dutch physicist, was chairman.

The position of this committee was considerably strengthened by the foundation in 1925 of the International Institute of Intellectual Cooperation in Paris, which provided a permanent international body recruited from specialists in the various branches of art and science for carrying out the resolutions of the committee and preparing the ground for future action.

Problems of scientific bibliography were among the first to engage the attention of the international committee and continue to occupy an important place in the activity of the scientific section.

The inquiry was first directed to the analytic bibliography of current literature in the case of the different sciences with a view to obtaining better results from the general bibliographical work which has been hitherto carried out in a disorderly and uncoordinate fashion in the different countries.

Having dealt with the physical and economic sciences, the question of biological bibliography was placed on the agenda of the international committee.

It should be pointed out that the technical difficulties encountered in the different sciences are practically the same and therefore the methods previously adopted for the other sciences have been applied in the case of biology.

The first step was to convene a meeting of experts, composed of editors of reviews especially devoted to the biological sciences. This meeting was held at the International Institute of Intellectual Cooperation on April 7 and 8, 1927.

The following were present:

Miss Bonnevie, professor of zoology at the University of Oslo, member of the International Committee on Intellectual Cooperation.

M. Apstein, *Zoologischer Bericht.*

M. Baur, *Zeitschrift für induktive Abstammungs- u. Vererbungslehre.*

M. Fedde, *Botanischer Jahresbericht.*

M. Kerkhof, Reichszentrale für Wissenschaftliche Berichterstattung.

Mr. Hutchinson, *Biological Abstracts.*

M. Fauré-Fremiet, *Année Biologique.*

M. Mesnil, Institut Pasteur.

Mr. Chalmers-Mitchell, *Zoological Record.*

M. Kooiman, *Resumptio Genetica.*

M. Racovitza, professor at the University of Cluj, correspondent of the International Committee on Intellectual Cooperation.

M. Strohl, *Concilium Bibliographicum.*

The above committee considered the actual problems of biological bibliography from many different aspects and passed the following resolutions concerning the methods to be employed in attempting a practical solution:

I. The committee of experts recognize that to obtain access to the literature is one of the greatest difficulties in the way of biological bibliography.

They are of the opinion that a great step in intellectual cooperation would be the reception, by those responsible for the preparation of abstracting and indexing publications, of separata (with the original pagination) of each memoir in scientific publications.

They recommend that steps should be taken, under the authority of the league, to induce the editors of journals publishing original work in biology to provide a limited number of separata of each paper sufficient to supply a copy to each bibliographical authority agreed upon by the conference, or its successors, as of international value.

They further recommend that an international organization (working through national bureaus if found more practical) be founded to receive the separata and distribute them to the appropriate bibliographical authorities.

II. The conference of experts are of the opinion that it would materially assist abstracting publications if an author's abstract were printed with every published paper.

They have been informed that the editors of some journals will not accept papers unless the authors have provided such an abstract, and they recommend that all editors should be invited to conform to this practice; such abstracts should average three to five per cent. of the original paper.

III. The committee of experts has considered a set of periodicals dealing with biological bibliography and has made a preliminary classification of them into groups, with the object of examining the possibility of cooperation and mutual help.

The classification is as follows: General biology; zoology; botany; systematics—zoology; systematics—botany; genetics; anatomy and embryology; microbiology and parasitology.

The following methods of cooperation are contemplated for each of these groups:

(1) Exchange of final proof-sheets (printed if possible on one side of the paper only), or of the publications themselves with rights of reproduction and translation, under conditions which might vary in the different cases.

(2) Separate sale of the bibliographical parts

(printed if possible on one side of the paper only) of those periodicals which also contain original matter.

IV. The committee of experts has charged certain of its members with the duty of getting into touch each in his own country with those most competent to prepare the details of cooperation.

The results of these negotiations shall be communicated to the institute, which shall make use of them in summoning first those interested in each separate group, and afterwards for the reunion of the full conference, which will be necessary before the attempt to bring into operation the proposed cooperative arrangements.

V. The conference of experts consider that a universally adopted system of abbreviations of the titles of periodicals would be an advantage which would outweigh the temporary inconvenience of changing the many existing systems.

They have been informed that bibliographical experts belonging to the British Museum have considered current systems and have devised a system which they have applied to the titles of 24,000 periodicals and that this list of abbreviations has been printed in Volume 2 of the World List of Scientific Periodicals.

They recommend that at their next meeting the possibility of the universal adoption of this system should be taken into favorable consideration.

These resolutions were approved by the international committee in July and by the Plenary Assembly of the league of Nations last September, and the institute was instructed to take the necessary action in order to put them into force.

It now remains to be seen whether biologists in general and in particular the editors of biological journals are sufficiently interested in this undertaking to make it a success.

As appears from the resolutions, the experts were of opinion that the different subdivisions of biology should be treated separately and the question now is to decide which of these subdivisions can most easily be made the subject of a common agreement, so as to concentrate on it in the first place.

Another aspect of the problem, which could not be dealt with at the time of the experts' meeting, is the extent to which our scheme should be altered in view of the publication of the *Biological Abstracts* in the United States, because before the meeting of the committee only one number had appeared.

The International Institute will welcome suggestions from the editors of biological reviews concerning the biological problems referred to in the experts' resolutions and will be glad to avail itself of their recommendations and collaboration in pursuing this work.

J. E. DE VOS VAN STEENWIJK

SECTION FOR EXACT AND NATURAL SCIENCES AT THE INSTITUTE OF INTELLECTUAL COOPERATION

SPECIAL ARTICLES

VARIATION IN SOLAR RADIATION

THE Lick Observatory Bulletin No. 401 carries a series of measurements of the brightness of the planet Uranus and of the satellites of Jupiter by Stebbins and Jacobson. Similar measurements were made by Stebbins in the year 1926, also at the Lick Observatory. They employ a potassium cell, most sensitive in the blue, at approximately 4,600 Ångstroms.

Measurements were made on about twenty nights of August and September, 1926, and on about fifty nights in July, August and September, 1927. During these intervals the Smithsonian Institution maintained daily observations of the solar constant of radiation at its station on Mount Montezuma, in Chile. It is interesting to compare the two series (omitting dates not common), to see what they may indicate as to the variation of the sun during these intervals.

In making such a comparison, one might proceed with the theory that the sun is equally bright at all parts of its surface, and, if it varies, it varies as a whole in brightness. But many indications lead us to the other view that although, associated with the march of solar activity revealed in sun-spots, there are changes of the general brightness of the whole solar surface, yet, just as the solar corona and the solar surface present much detail to the telescope, so the sun as a source of radiation presents inequalities of surface brightness turned toward the different directions in space. Accordingly, it seems best to take into account the heliographic longitude of the satellites and the planet observed by Stebbins, and also to consider the time occupied by light in traveling from

OBSERVATIONS OF 1926

Dates		Departures: Tenths per cent.		Difference—Montezuma from Satellites
Montezuma	Lick	Montezuma	Lick	
August				
24	24	−1	+ 1	2
25	25	−1	+ 1	2
27	27	+4	− 5	9
28	28	−1	− 2	1
30	29	+2	−10	12
32	31	−2	+ 1	3
Sept.				
2	1	+1	− 2	3
3	2	−2	− 2	0
4	3	−1	0	1
5	4	+2	− 4	6
6	5	+2	+ 5	3
7	6	+4	+ 2	2
8	7	−1	− 1	0
9	8	−2	+ 7	9
		—	—	—
	Means:	2	3	4

the sun to these distant mirrors and thence to the earth, and to correct the dates of the observations of Stebbins and his colleague to correspond with the dates of observation of the solar constant, by allowing for the time intervals required for the sun to rotate from the direction of the satellites and the planet to the direction of the earth.

The Lick observations are published as departures in stellar magnitudes from the mean brightness of the objects during the whole interval of observation. The solar constant measures at Mount Montezuma are given in calories per square centimeter per minute. I have reduced all these results from both stations to the corresponding condition of percentage departures from the mean values prevailing during the periods of observation. To avoid repetition of useless figures, I express these departures in tenths of a per cent.

It will be noted that the range of departures for the solar constant scarcely exceeds 1 per cent., while the range of the photoelectric measurements is somewhat greater. Stebbins and Jacobson decided that the measurements on Uranus in 1927 have greater weight than those on the satellites, as is indeed indicated by their smaller range.

The solar constant values as here employed are all reduced by the definitive method in which every known source of error has been eliminated, including systematic errors requiring several years of observation for their determination. They are as accurate, we think, as can ever be obtained.

On the whole, there is agreement on both sides that the short-interval solar variations during these periods were very minute. As the photoelectric measurements are not quite equal in accuracy to the solar constant measurements, it is not possible to be sure whether they really support one another in singling out any of the apparent minute solar variations as real. The agreement between Montezuma and Uranus from July 27 to August 10, 1927, is very close, but reveals no considerable solar changes. During the interval from August 19 to August 31, when Montezuma seems to indicate a range of 1 per cent. very consistently, the agreement, otherwise close, is marred by four considerable departures.

OBSERVATIONS OF 1927

Dates Montezuma	Dates Lick Satellites	Dates Lick Uranus	Departures: Tenths per cent. Montezuma	Departures: Tenths per cent. Lick Satellites	Departures: Tenths per cent. Lick Uranus	Differences—Montezuma from Lick Satellites	Differences—Montezuma from Lick Uranus
July	July						
27	24	23	+2	− 4	− 1	6	3
28	25	24	+1	−24	− 2	25	3
29	26	25	−3	− 8	− 2	5	1
30	27	26	+1	−10	− 4	11	5
31	28	27	0	.....	− 1	3	1
32	29	28	−1	− 4	− 1	3	0
33	30	29	+1	− 2	− 1	1	2
34	31	30	−1	− 2	0	3	1
35	32	31	−1	+ 2	0	.....	1
August	August						
5	2	1	0	+ 6	− 2	6	2
6	3	2	0	− 6	− 2	6	2
7	4	3	+1	.....	− 2	.....	3
9	6	5	−2	−13	− 2	11	0
10	7	6, 7	−1	− 1	− 1	0	0
11	9	8	−5	+ 4	0	9	5
14	12	11	−2	.....	+ 4	.....	6
17	15	14	0	+ 4	+10	4	10
18	16	15	+2	− 1	+11	3	9
19	17	16	−5	+ 6	− 3	11	2
20	18	17	−1	+11	− 9	12	8
21	19	18, 19	−6	+10	+ 4	16	10
22	21	20	−4	− 1	+ 9	3	13
23	22	21	−5	+ 2	− 6	7	1
24	23	22	−4	− 4	+ 1	0	5
26	25	24	−2	.....	+11	.....	13
28	27	26	−2	.....	− 2	.....	0
31	30	29	+5	.....	+ 6	.....	1
Sept.	Sept.						
3	3	2	0	.....	+ 6	.....	6
6	6	5	0	−20	− 4	20	4
19	19	19	0	0	+ 4	0	4
20	20	20	+1	.....	− 3	.....	4
21	21	21	+5	− 2	− 2	7	7
22	22	22	0	.....	− 6	.....	6
23	23	23	+3	− 2	− 4	5	7
24	24	24	+2	0	+ 5	2	3
29	29	29	−1	− 2	− 2	1	1
Means:			2	6	4	7	4

It will be noted that the range of departures for the solar constant scarcely exceeds 1 per cent., while the range of the photoelectric measurements is somewhat greater. Stebbins and Jacobson decided that the measurements on Uranus in 1927 have greater weight than those on the satellites, as is indeed indicated by their smaller range.

The solar constant values as here employed are all reduced by the definitive method in which every known source of error has been eliminated, including systematic errors requiring several years of observation for their determination. They are as accurate, we think, as can ever be obtained.

On the whole, there is agreement on both sides that the short-interval solar variations during these periods were very minute. As the photoelectric measurements are not quite equal in accuracy to the solar constant measurements, it is not possible to be sure whether they really support one another in singling out any of the apparent minute solar variations as real. The agreement between Montezuma and Uranus from July 27 to August 10, 1927, is very close, but reveals no considerable solar changes. During the interval from August 19 to August 31, when Montezuma seems to indicate a range of 1 per cent. very consistently, the agreement, otherwise close, is marred by four considerable departures.

C. G. ABBOT

SMITHSONIAN INSTITUTION

SOCIETIES AND ACADEMIES

THE NORTH CAROLINA ACADEMY OF SCIENCE

THE twenty-seventh annual meeting of the North Carolina Academy of Science was held at the University of North Carolina, Chapel Hill, N. C., on April 27 and 28, 1928. Papers were presented before the general section of the academy on Friday morning and afternoon. Friday evening the retiring president, Dr. J. M. Bell, gave his presidential address on "Some Approaches to Fundamental Theory of the Physical Sciences." Saturday morning the academy met in the following sections: General section, chemical section, mathematics section and physics section. Seventy-nine papers and five exhibits were on the program (abstracts of most of these papers and complete papers of several will appear in an early num-

ber of the *Journal of the Elisha Mitchell Scientific Society*).

The executive committee reported the election of fifty-seven new members during the year and the reinstatement of eight former members. One hundred and sixty-five were present for the meeting.

Mr. H. E. Biggs, Jr., a student in the Greensboro high school, was declared the winner of the high school science prize, a silver loving cup, for the best essay submitted by a high-school student. (Essays for 1928 were confined to the fields of chemistry and physics).

The officers elected for the year 1929 were:

GENERAL ACADEMY

President, J. S. Holmes, state forester.

Vice President, Miss Mary Petty, North Carolina Woman's College.

Secretary and treasurer, H. R. Totten, University of North Carolina.

Executive committee, The above officers and J. W. Nowell, Wake Forest College; A. H. Patterson, University of North Carolina; and F. A. Wolf, Duke University.

Representative to the A. A. A. S., Bert Cunningham, Duke University.

CHEMICAL SECTION

Chairman, L. G. Willis, State College.

Secretary, L. B. Rhodes, State Department of Agriculture.

Councillor, A. S. Wheeler, University of North Carolina.

MATHEMATICS SECTION

Chairman, J. W. Lasley, Jr., University of North Carolina.

Secretary, W. W. Elliott, Duke University.

PHYSICS SECTION

Chairman, W. T. Wright, North Carolina Woman's College.

Secretary, C. C. Hatley, Duke University.

The twenty-eighth annual meeting of the Academy will be held at the North Carolina Woman's College, Greensboro, N. C., in the spring of 1929.

H. R. TOTTEN,
Secretary

THE KANSAS ACADEMY OF SCIENCE

THE sixtieth annual meeting of the Kansas Academy of Science was held at the Municipal University of Wichita, with one session at the Wichita High School, April 13 and 14, 1928. Two sessions on the first day and the forenoon of the second day were devoted to the presentation of papers and to business.

Dr. H. W. Foght, president of the university, gave a short address of welcome. The Wichita Chamber of Commerce sponsored a trip to the airplane factory. Following a banquet at the University cafeteria in the evening of April 13, the annual presidential address of the academy was given by Dr. Mary T. Harman, of the Kansas State Agricultural College. The subject of her address was "The Physical Unit of Life."

Officers were elected as follows:

L. D. Wooster, *president*, Hays State Teachers College.

W. B. Wilson, *first vice-president*, Ottawa University.

Hazel E. Branch, *second vice-president*, Municipal University of Wichita.

L. D. Havenhill, *treasurer*, University of Kansas.

G. E. Johnson, *secretary*, Kansas State Agricultural College.

Additional members of the executive council: E. O. Deere, E. A. White, F. C. Gates, Mary T. Harman.

Thirty-two papers were presented.

The Kansas Entomological Society met on April 14 in conjunction with and became affiliated with the academy.

The academy will meet at the Kansas State Agricultural College at Manhattan in 1929.

GEORGE E. JOHNSON,
Secretary.

THE INDIANA ACADEMY OF SCIENCE

THE spring meeting of the Indiana Academy of Science was held at Logansport, Indiana, on May 17, 18 and 19, with over one hundred members in attendance.

The area along the Wabash and Eel Rivers in this region is a particularly good one for the study of the Silurian stratigraphy and associated coral reefs.

Auto tours in all directions from Logansport gave botanists, zoologists as well as the geologists, ample opportunity for studying the subjects in which they were interested.

Dr. E. R. Cummings and Mr. Robert Schrock, of Indiana University, who have made a special study of the area, acted as guides and explained the geological features.

Dr. Ernest Carman and Dr. Paris Stockdale, of the department of geology of Ohio State University, attended the meeting.

The program committee consisted of Dr. Paul Weatherwax, of Indiana University, *chairman*, assisted by Drs. C. L. Malott, of Indiana University; E. B. Mains, of Purdue University; and W. M. Blanchard, of De Pauw University.

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The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE PLANETARIUM

WITH the vanguard of the thousands of American tourists who will visit Germany during the coming months now reaching Berlin, the planetarium is attracting large crowds. Many of the Americans wish to see in operation this device that reproduces the night sky on a white dome, and which will soon make its debut in the United States when one is installed in Chicago.

Since the first planetarium was erected in 1924 in Jena, on the roof of one of the buildings of the Carl Zeiss optical works, its manufacturers, fourteen other German cities have installed them, including Munich, Berlin, Hamburg, Hanover, Dusseldorf, Barmen, Leipzig, Stuttgart, Nuernberg and Mannheim. One has been installed in Vienna; Mussolini has ordered one for Rome, which will be opened this fall; while the Soviet Government has also ordered one for Moscow.

The planetarium is a huge instrument, consisting of a long cylinder, with two spherical ends. Imbedded in the spheres, and also along the cylindrical parts, are a number of lenses, 119 in all. These act as magic lanterns to project the images of the naked eye stars, the Milky Way, the sun, moon and planets on the white cloth-lined dome. So realistic is the effect that when the room is darkened and the visitor has become used to the dim light, the stars appear as in the actual night sky. The visitor does not seem to be in a 90-foot dome, but under the stars themselves on a cloudless night.

The mechanism of the machine, all controlled by the lecturer from a single switchboard, will enable it to reveal the stars as seen from the North Pole, the South Pole, or any place between. The "great year," of 26,000 ordinary years, can be duplicated in a few minutes, and the heavens shown as they appeared thousands of years ago. Five thousand years ago our present pole-star was not in that prominent position, but it was occupied by the star we call alpha Draconis. At that time also, the Southern Cross was visible from the present latitude of New York. This can be shown with the planetarium. When desired, the names of the constellations can be flashed on the sky in the proper places, as if on huge electric signs!

The phases of the moon as it spins around the sun, along with the earth, are displayed. So are the motions of the planets. These can be speeded up so that the events of a year take place in a few seconds. The sun speeds across the dome with Mercury and Venus looping around it. The alternate forward and backward motion of Jupiter and Saturn, hardly visible in reality because of their slowness, become immediately apparent. Yet so accurate is the mechanism that, if the planets are shown as they would appear 5,000 years hence, Mercury, the fastest moving of them, is out of its proper place less than the diameter of the full moon.

Most of the German planetariums are operated by the school boards of the respective cities, but for general visitors an admission charge of one mark is usually made. Despite this, the popularity of them has been so great that in the four years since the first one more than a million paid admissions have been recorded in Germany. This has gone far towards paying the cost. The instrument itself sells for about $40,000, and the cost of the building is from about $150,000 upwards.

By this time next year, Chicagoans will be able to see, without leaving the city, the first planetarium in the western hemisphere. Max Adler, former Sears-Roebuck official, has just given $500,000 to the city for one of these instruments and the building to house it. An island in Lake Michigan, near the Field Museum, has been selected as the site. Mr. Adler will shortly leave for Germany to study the instrument at Jena, home of the Carl Zeiss optical works where it is built, as well as other German cities, and will personally supervise its erection in Chicago.

RECENT INDIAN MOUND-BUILDERS

THE last traces of the old idea that the mound-builders were a mysterious ancient race who vanished before the coming of the Indians have been very effectually destroyed by the discovery in Joliet, Ill., of a mound filled from bottom to top with the skeletons of buried Indians, each skeleton provided with funeral gifts of European manufacture as well as the more usual stone, bone and shell objects of native workmanship. Professor Fay-Cooper Cole, of the University of Chicago, states that so far as he is aware this is the first wholly post-European mound discovered in this country.

The mound is one of the so-called Fisher group, which have been subjected to excavation during the past few years by George Langford, a factory executive of Joliet. The other mounds have yielded Indian relics of pre-European date, one of the cultures represented being very primitive and possibly very ancient. A few articles of white man's manufacture were found near the top of one of these larger mounds, linking the history of the Indians of this region with that of French Colonial trading in the Mississippi Valley.

The mound which Mr. Langford has just finished exploring had been given a somewhat superficial going over by an earlier group of amateur diggers, who found a considerable number of silver objects, including a crucifix, several spoons, bangles and other ornaments. It was thought that everything had been removed, but when Mr. Langford dug into the mound again he discovered that the previous excavation had done little more than remove the surface. He found burials with European and Colonial funeral gifts throughout the mound and down into the ground to a depth of five feet beneath its base.

The finds include a couple of brass pots in excellent condition, one of them with a close-fitting lid, a pair of scissors, a large number of knives bearing a French trade-mark, several silver spoons and quantities of beads, but-

NEW SCIENTIFIC BOOKS

The Institute for Government Research, Washington, D. C.

THE PROBLEM OF INDIAN ADMINISTRATION. Lewis Merriam and associates. pp. xxii + 872.

Report of a survey of the economic and social conditions of the American Indians, containing the following sections: A General Policy for Indian Affairs; Health; Education; General Economic Conditions; Family and Community Life and the Activities of Women; Migrated Indians; Legal Aspects of the Indian Problem, and Missionary Activities.

Longmans Green and Company, New York

INTERMEDIATE ELECTRICITY AND MAGNETISM. R. A. Houston. pp. x + 170. 155 diagrams. $1.75.

Treats of the fundamental facts of magnetism, magnetic measurements, terrestrial magnetism, electrostatics, Ohm's law, electrolysis, induced currents, cathode rays, X-rays and radioactivity. An additional chapter on electrical oscillations and waves is included.

The D. Van Nostrand Company, New York

STORAGE BATTERIES. Morton Arendt. pp. v + 285. Illustrated. $4.50.

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Prentice-Hall, New York

GENERAL CHEMISTRY. Azariah T. Lincoln and George B. Banks. 133 figures. pp. xxii + 681. $3.50.

Suited for a first-year course in college. The material is so arranged that several sizes and types of courses can be offered, depending on the group of students concerned and the amount of time available.

Allyn and Bacon, Boston

SECOND COURSE IN THE NEW MATHEMATICS. Edward I. Edgerton and Perry A. Carpenter. pp xi + 369. $1.20.

This is the second-year volume of a mathematics series for junior high schools. The first part of the book is devoted to saving time in the use of fundamental processes. The second part makes specific application of the New Mathematics to business.

Boni and Liveright, New York

GROWING INTO LIFE. David Seabury. pp. xviii + 715. $5.00.

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tons, pins and other trinkets. Brass seems to have been a favorite metal; every skeleton had some brass object with it. These modern mound-builders unquestionably did a lot of business with the French traders.

One of the most remarkably well-preserved specimens is a combination pocket compass and sun-dial in a brass case. The "floating" compass card swings freely on its pivot, the glass cover is unbroken, and the gnomon of the sun-dial can still be turned on its hinge.

A change in the type of burial may possibly be due to European influence. All the adult skeletons in this post-European mound lay flat on their backs, heads west, feet east. This resembles the white man's method of burial. All the other deep burials at the Fisher site, whose funeral gifts do not include European objects, were turned over on one side and drawn up into a crouching position, as primitive peoples are wont to sleep in cold weather.

ARCTIC EXPLORATION AND THE "ITALIA"

GENERAL NOBILE'S *Italia*, now down in the Arctic, was too small and slow for serious Arctic exploration, and German authorities warned him against using it. This is the opinion of Dr. Walter Bruns, general secretary of the International Society for the Exploration of the Polar Regions by means of the Airship, generally known as "Aeroarctic." The society is particularly interested, as several of its members are with the Nobile expedition. Also, Aeroarctic is itself planning extensive polar explorations next year in the *LZ–127*, the gigantic Zeppelin now nearing completion at Friedrichshafen. This ship is six times as large as the *Italia*, and even larger than the American *Los Angeles*.

"In spite of its great sympathy towards the undertaking," said Dr. Bruns, "the Aeroarctic has had, from the very beginning, serious concern regarding the expedition. It was pointed out to Nobile that, after the wonderful flight of the sister ship *Norge*, too distant a goal for a new expedition this year should, before all things, be avoided for this very small type of airship. We know from our Berlin conferences with General Nobile that, because of the small size of the airship, the mass of the necessary reserves of ballast (in case the ship were covered with ice), and the polar equipment requisite for a possible forced landing, had to be reduced greatly on account of the great distance.

"The small speed (about 53 miles per hour) of the airship required that General Nobile spend the month of April and the first half of May, the most precious time for polar work, awaiting favorable meteorological conditions. Already the flight to Nicholas II Land (Leninland) had demonstrated that it was really too late for further undertakings because of the prevalence of summer fogs. In addition to the unpromising meteorological conditions, General Nobile had to fix the base of his operations at Kings Bay in the Arctic itself, owing to the small radius of action of his airship. This again made him not only dependent upon the general weather conditions but also upon the local storm phenomena (winds, snowstorms, etc.) which are often very troublesome. The snow even penetrated the hangar and made it very inconvenient for the airship in its shelter.

"The very favorable flight to the Pole justified the hope that the return trip would likewise be propitious. Under good weather conditions, the journey from Kings Bay to the Pole and back is no great undertaking for an airship. This, however, is not the case, in view of the small speed of the *Italia*, as soon as a moderately strong contrary wind arises, as apparently took place on the return trip. That General Nobile on approaching Spitzbergen met with strong adverse winds is, from a meteorological standpoint, not strange, since the region of Spitzbergen is in the area of storm paths which take their course from the North Atlantic along the Norwegian Coast and only gradually die out in the inner Arctic, *i.e.*, become less dangerous for flights.

"Our society has, therefore, as is generally known, held firmly to the opinion that the solution of Arctic problems should not be attempted with too small an airship. In order to be independent of the especially unfavorable storm conditions of Spitzbergen, one should, before all else, establish his base for Arctic exploration as far distant as possible from the Arctic. For this reason we plan for next year's expeditions, anchorages in Leningrad, and perhaps at Murmansk in Kola, and at Nome in Alaska. We wish also, in spite of the very great cruising radius of the new Zeppelin-airship which may be three times that of the *Italia*, to establish anchorages on both sides of the Arctic in order to be approximately independent of meteorological factors during our journeys covering several days."

TUBERCULOSIS

THE need for careful supervision of tuberculosis patients discharged from sanatoriums as cured was described as an economic as well as a sociologic need by Dr. H. Longstreet Taylor, of St. Paul, in the presidential address before the annual meeting of the National Tuberculosis Association which opened in Portland, Oregon, on June 17.

Every relapse doubles the original cost of the care of the patient, a burden that generally falls on the community at large, said Dr. Taylor. A third period of treatment, the "cure to end the cure," was recommended as having but trifling cost compared to that of caring for relapses. Figures from the Metropolitan Life Insurance Co. showed that of 896 patients who had this after-care, 80 per cent. were at work seven years after discharge from the sanatorium. On the other hand, a survey of unsupervised patients in New York City revealed that 52 per cent. had suffered relapses within one year after leaving the sanatorium.

Of 148 cases of pulmonary tuberculosis during the last seven years in which surgery was used, 41 per cent. were cured and 33 per cent. improved, Dr. William H. Thearle, of Denver, reported to the meeting of the association. By this method of treatment, known as thoracoplasty, part of the ribs are cut away. The lung collapses, so that it is completely at rest and thus has a chance to heal. The results with this method of treat-

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ment were characterized as "brilliant" by Dr. Thearle. However, proper selection of cases for this procedure is of great importance and further progress along this line will depend on the degree of cooperation between internist and surgeon.

The task of the industrial physician in determining whether or not a worker contracted tuberculosis as a result of his occupation, and was thus entitled to compensation, was described and difficulties pointed out to members of the association by Dr. John B. Hawes, 2nd, and Frank Kiernan, of Boston. In eleven of 76 cases considered by the Industrial Accident Board of Massachusetts during the last two years, there had been direct exposure to tuberculosis for many years through another member of the family.

Present training for public health work is of three types. The first is the standard nurses' training, the second supplements the nurses' training with a period of training in social work, the third adds to the training of nurse and social worker such academic and cultural training as may be obtained by a regular college or university course and finishes with specialized training for research in social health work. This last type is still in the experimental stage and all the types are constantly undergoing change and improvement, members of the association were told by Dr. Philip A. Parsons, of Eugene, Ore.

Light is a valuable factor in the cure of tuberculosis, but it must not be considered as the sole agent. There are other and more important ones, such as diet, rest and fresh air, Dr. Clarence L. Hyde told members of the National Tuberculosis Association at their meeting. "Heliotherapy is much more than a bath in sunlight," said Dr. Hyde. Treatment with artificial lights, while it may reproduce the rays, can not equal actual sunlight treatment which is accompanied by changing air currents, differences in atmospheric temperature and humidity, and constant variations in the sunlight itself. These features all have importance in the value of sunlight treatment. A method of using an open flame carbon arc, which Dr. Hyde considered the most satisfactory substitute for sunlight, was described.

ITEMS

A HOUSE without a single sliver of wood in its construction is being built in Gary, Ind., for the president of a local steel company. The framework is made of angle-irons with a complete system of diagonal bracing. Both bolting and electric welding is used to fasten the steel together. Concrete is used in the foundation and for the floors, while stairs, sills and interior trim are all steel.

THE quantity of water underground, beneath the crust of the earth's surface, is nearly one third the total volume of the oceanic waters, according to estimates of Dr. Chester A. Reeds, of the American Museum of Natural History, who has just completed investigations of buried rivers and caves. The earth's ground water extends to great depths, perhaps six miles, and has been accumulating for countless ages. This great mass of water percolates slowly through the porous and jointed rocks to form great systems of underground drainage, creating such beauty spots as the Mammoth Cave, in Kentucky, and the Endless Caverns, in Virginia. In the limestone regions, where so many of these unfamiliar streams are found, the formations of huge stalactites, stalagmites, columns and stony curtains in the cavernous depths remind one of the artistic handiwork of ancient artisans on the Renaissance palaces.

WHETHER or not flowers will reproduce may be traced to the size and general appearance of the pollen grains, according to a report to the western division of the American Association for the Advancement of Science. Miss Laura E. Shaw, of the University of Southern California, separated pollen grains into four groups according to size and found that the third group, containing grains of from three to four thousandths of an inch and comprising half of the grain studied, gave the highest percentage of germination, the rate being 75 to 80 per cent.

FOOD is digested, absorbed and made available for doing the body's work just as effectively when liquid petroleum is added to the diet as when inert laxative oil is not taken with the food, according to a report to the American Medical Association by Dr. Alfred B. Olsen, of Battle Creek Sanitarium, who reported experiments on dogs and human beings.

THE hard-worked liver diet is to have an assistant in curing patients of pernicious anemia. Ultra-violet rays which have been used both with and without the liver have caused a marked improvement in the condition of these patients, according to Dr. David I. Macht, of Baltimore. An increase in hemoglobin and number of red blood cells resulted from the use of these rays. The toxic effect of the blood serum, which is believed to be a causative factor in this disease, decreased.

WHEN the rogues' gallery of plants causing hay fever has been checked over, the paper mulberry tree which flourishes in back yards and vacant lots has always been pronounced innocent. But now, Dr. Harry S. Bernton, specialist in this disease, has reported the first cases in which hay fever was traced to the baleful pollen of the paper mulberry. Three cases have been found by Dr. Bernton in the past two years.

MEASLES, whooping cough, digestive ailments and other diseases attack more boys than girls under 10 years, according to a survey made by the U. S. Public Health Service. However, after the boy is 10 years old, unless he breaks a collar bone or suffers other injury in the course of his more venturesome activities, he will spend less time in bed sick than his sisters of the same age. This bears out the previous morbidity and mortality experience of health officers which gives male infants a handicap over girl babies, but reverses the condition during adolescence and maturity.